may, 1960

nlgi spokesman

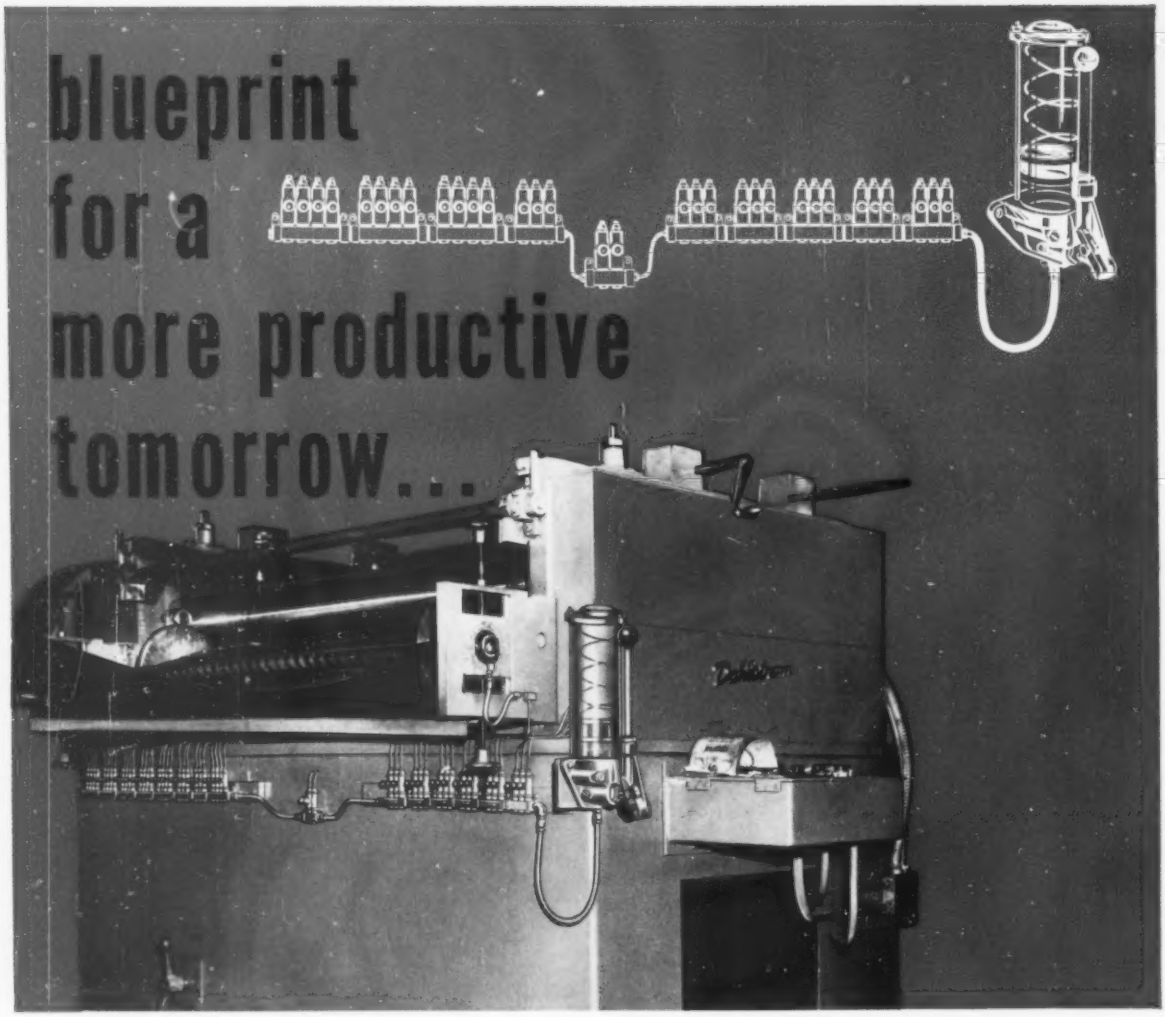
journal of the national lubricating grease institute

A Review of NLGI's Tentative Dispensing Method
By R. D. SKOGLUND

Development of a Chart for Predicting the Pumpability of Greases
By W. L. GABBERT

The NLGI Dispensing Method – Comment on Papers by R. D. Skoglund and W. L. Gabbert
BY M. EHRLICH

Definitions of Terms Relating to the Lubricating Grease Industry– Part III
By W. J. EWBANK



A Lincoln Centralized Lubrication System

In seconds a Lincoln Centralized Lubrication System lubricates all bearing surfaces while machinery is operating. It assures that every bearing gets the right amount of lubricant at the right time, whether you use the simpliest, manually-operated CentrOluber* or a completely automatic CentrOmatic* System. Centralized lubrication cuts downtime and bearing replacement, boosts plant efficiency and production.

Lincoln systems can be actuated by hand, reciprocating motion, air or electricity. There are 26 systems available to meet every lubricant application requirement . . . including *yours*. Mail the coupon today for complete details and specifications.

*Registered Tradename.

Coast-to-Coast Sales and Service through 16 Branch Offices and Leading Industrial Distributors.

1046

Lincoln

LINCOLN ENGINEERING CO
Division of The McNeil Machine & Engineering Co.
St. Louis 20, Missouri

LINCOLN ENGINEERING CO.
5703-37 Natural Bridge Ave., St. Louis 20, Mo.

Please send my complimentary copy of Catalog 81 on Lincoln Centralized Lubrication Systems.

Name.....Title.....

Company.....

Address.....

City.....Zone.....State.....

nlgi spokesman

Volume XXIV May, 1960 Number 2

Published Monthly by the National Lubricating Grease Institute, T. W. H. MILLER, Editor; VIRGINIA ALLEN, Assistant Editor, 4638 J. C. Nichols Parkway, Kansas City 12, Missouri. Telephone: VAlentine 1-6771. 1 Year Subscription, $5.00. 1 Year Subscription (Foreign), $6.00.

OFFICERS

President: H. A. MAYOR, JR., Southwest Grease and Oil Co., 220 W. Waterman, Wichita, Kans.

Vice-President: F. R. HART, Standard Oil Co. of California, 225 Bush Street, San Francisco, Calif.

Secretary: C. L. JOHNSON, Jesco Lubricants Co., P. O. Box 7331, North Kansas City, Mo.

Treasurer: A. J. DANIEL, Battenfeld Grease and Oil Corp., Inc., 3148 Roanoke Road, Kansas City 11, Mo.

DIRECTORS

W. W. ALBRIGHT, Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.

S. C. M. AMBLER, British American Oil Co., Bay & College St., Toronto, Ontario, Can.

T. W. BINFORD, D-A Lubricant Co., Inc., 29th St. and Canal, Indianapolis 23, Ind.

E. W. CAMPBELL, Gulf Oil Corp., Gulf Building, Pittsburgh, Pa.

J. J. COATES, Esso Standard Div., Humble Oil & Refining Co., 34th and Smallman St., Pittsburgh 1, Pa.

R. CUBICCIOTTI, Sonneborn Chemical & Refining Corp., 300 Park Avenue, South, New York, N. Y.

GEORGE LANDIS, Atlantic Refining Co., 260 S. Broad St., Philadelphia 1, Pa.

J. W. LANE, Socony Mobil Oil Co., Inc., 150 E. 42nd St., New York 17, N. Y.

W. A. MAGIE, II, Magie Brothers Oil Co., 9101 Fullerton Avenue, Franklin Park, Ill.

G. E. MERKLE, Fiske Brothers Refining Co., 129 Lockwood Ave., Newark 5, N. J.

F. W. MINOR, Sinclair Refining Co., 600 Fifth Avenue, New York 20, N. Y.

W. M. MURRAY, Kerr-McGee Oil Industries, Inc., Kerr-McGee Bldg., Okla. City, Okla.

G. A. OLSEN, Sunland Refining Corp., P. O. Box 1512, Fresno, Calif.

F. E. ROSENSTIEHL, Texaco, Inc., 135 East 42nd Street, New York 17, N. Y.

W. H. SAUNDERS, JR., International Lubricant Corp., Box 390, New Orleans, La.

T. F. SHAFFER, Shell Oil Co., 50 West 50th Street, New York 20, N. Y.

Technical Committee Chairman: L. C. BRUNSTRUM, Standard Oil Co. (Indiana) Whiting Research Laboratory, Box 431, Whiting, Ind.

General Manager: T. W. H. Miller, NLGI, 4638 J. C. Nichols Parkway, Kansas City 12, Mo., VAlentine 1-6771

IN THIS ISSUE

President's Page 38

News About NLGI 40

Future Meetings 43

A Review of NLGI's Tentative Dispensing Method 47
R. D. Skoglund, Texaco, Inc.

Development of a Chart for Predicting the Pumpability of Greases 55
W. L. Gabbert, Lincoln Engineering Co.

The NLGI Dispensing Method—Comment on Papers by R. D. Skoglund and W. L. Gabbert 60
M. Ehrlich, American Lubricants, Inc.

Definitions of Terms Relating to the Lubricating Grease Industry—Part III 62
W. J. Ewbank, Cato Oil & Grease Co.

Literature and Patent Abstracts 65

Industry News 72

People in the Industry 76

THE COVER

HERE is another tool in the big push to get the customer up on the lube rack. Our cover shows a scene from a dramatic motion picture, the latest information and training device. Offered without charge to the industry by the producer, Lincoln Engineering, the 16-mm film entitled "You—the Jury" is a bright, easy approach to selling the services of the lube bay. In sixteen minutes the viewer has the story. Lincoln has made the picture available to oil companies, as may be shown elsewhere in this issue, including the "News about NLGI" and "Industry News" sections.

The NLGI SPOKESMAN is indexed by Industrial Arts Index and Chemical Abstracts. Microfilm copies are available through University Microfilm, Ann Arbor, Mich. The NLGI assumes no responsibility for the statements and opinions advanced by contributors to its publications. Views expressed in the editorials are those of the editors and do not necessarily represent the official position of the NLGI. Copyright 1960. National Lubricating Grease Institute.

NLGI PRESIDENT'S PAGE

By H. A. MAYOR, JR., *President*

An Open Letter

Mr. Adam Rumoshosky
Director
American Petroleum Institute
Division of Marketing
1271 Avenue of the Americas
New York 20, New York

Dear Adam:

As has been so well written in the trade press, that was a wise, sparkling, and witty speech you made to the Iowa Oil Jobbers at their Annual Meeting earlier this year.

And here's one guy who is in complete agreement with you that it's not "oversupply" that's plaguing the petroleum marketer, but instead "underconsumption."

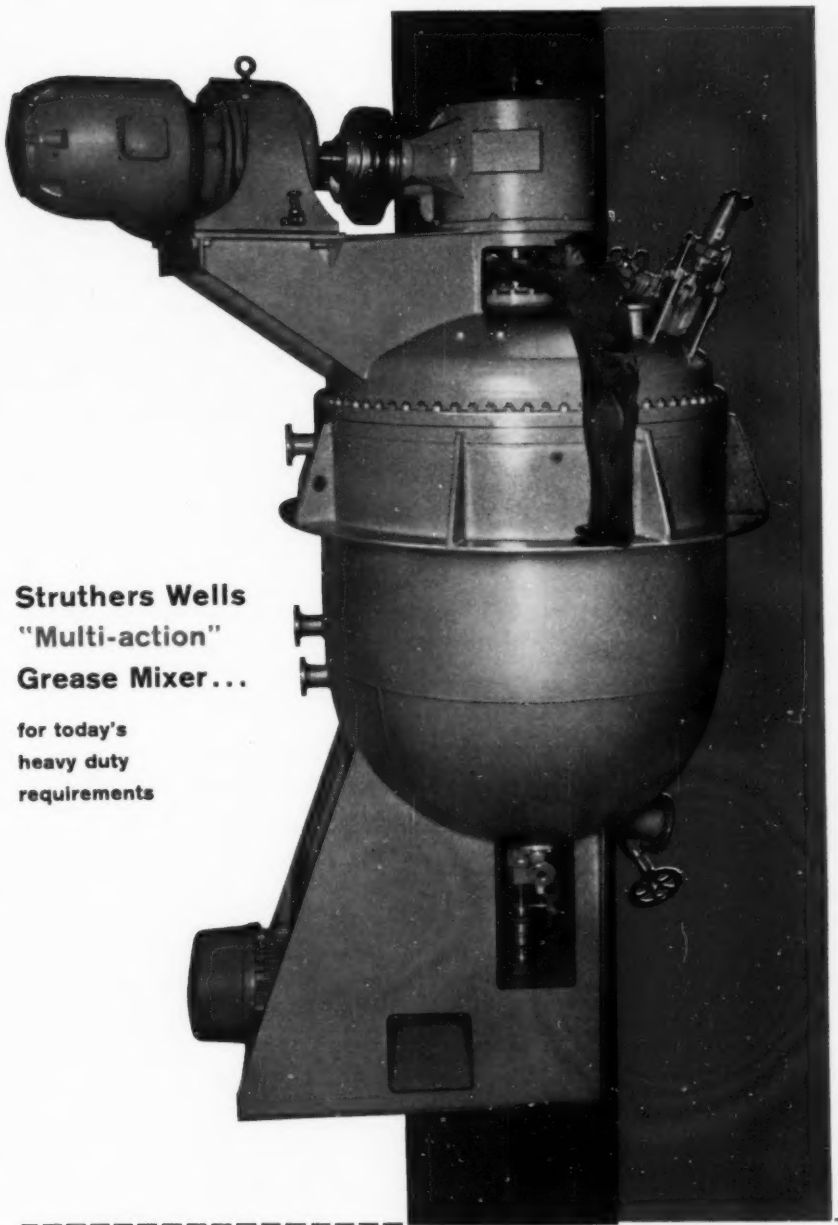
Because the future of the lubricating grease industry is tied so closely to the future of the entire petroleum marketing industry, the NLGI very much appreciates the good work you are doing on behalf of marketing at these jobber meetings. A renewed emphasis, at all industry levels, on a program to sell the "market" instead of the "product" cannot help but benefit all of us.

Keep up the good work!

Yours very truly,

H. A. MAYOR, JR.
President

increased production up to 4 times—time saving, 30% to 80%



Struthers Wells
"Multi-action"
Grease Mixer...

for today's heavy duty requirements

In full scale production since 1957, this "Multi-action" Grease Mixer has accelerated production and improved heat transfer. It does the work of 4 "old type" machines—provides rapid heat exchange, excellent mixing and dehydration. Results: sensational savings in time and money.

Struthers Wells

STRUTHERS WELLS CORPORATION

WARREN, PENNSYLVANIA

Plants at Warren and Titusville, Pa.

PROCESSING EQUIPMENT DIVISION
Crystallizers . . . Direct Fired Heaters . . . Evaporators . . . Heat Exchangers . . . Mixing and Blending Units . . . Quick Opening Doors . . Special Carbon and Alloy Processing Vessels

BOILER DIVISION
BOILERS for Power and Heat . . . High and Low Pressure . . . Water Tube . . . Fire Tube . . . Package Units

FORGE DIVISION
Crankshafts . . . Pressure Vessels . . . Hydraulic Cylinders . . . Shafting . . . Straightening and Back-up Rolls

New brochure tells the complete story
Send coupon TODAY for your copy

STRUTHERS WELLS CORPORATION
WARREN, PENNSYLVANIA

Gentlemen: Please send me a copy of the "Multi-action" Grease Mixer, Bulletin 581.

Name_____

Title_____

Company_____

Address_____

News About NLGI

Lubrication Engineers Joins NLGI

Lubrication Engineers, Inc., of Fort Worth, Texas, has joined NLGI as a Marketing member. James P. Bell, president, will act as Company Representative to the Institute. A feature story on this new affiliate will appear in a later issue of the journal.

Lincoln Film Available To NLGI Members

The NLGI national office has received a complimentary copy of "You—the Jury," an eighteen-minute movie in 16 mm color with sound, produced by Lincoln Engineering company. The picture proves in a dramatic enactment how profits may be earned in the lube bay . . . a light hearted film which makes a serious point. Members may obtain the Institute copy for viewings without charge by writing NLGI.

McCowan Is Representative

Sun Oil has placed R. C. McCowan as Company Representative of this Philadelphia Active member.

Volume XXIII Is Off the Press

Volume XXIII of the NLGI SPOKESMAN is now available to members and friends of the Institute. Covering material presented in twelve issues from April, 1959 through March, 1960, the book includes 36 feature articles on lubricating greases and fluid gear lubricants, with an index on authors, titles and categories, in the final number.

Bound in the traditional handsome green hard cover, with gold lettering, on the front and side, Volume XXIII is a valuable aid to the industry and may be used effectively in office or laboratory. Cost to members is $7.50 and to friends of NLGI the charge is $10.50 . . . plus postage.

An unlimited number of Volumes XXI and XXII are still available, while a very few of Volume XX may be obtained from the national office.

Mallinckrodt Names Caughlan Representative

Mallinckrodt Chemical has named J. A. Caughlan as Technical Representative to NLGI from this Associate member firm.

Members Receive Production Survey

The third annual survey on production of lubricating greases and fluid gear lubricants conducted by NLGI was concluded early in April. Members of the Institute in all four classifications received copies of the information shortly after April 15.

This third compilation, a gathering of 1959 production data from Institute Active (manufacturing) members in the United States and Canada, may be obtained by nonmembers for ten dollars by writing the national office. For further information on the survey, please see the article on page 44.

SERVICE AIDS

Send Orders to: National Lubricating Grease Institute, 4638 Nichols Pkwy., Kansas City 12, Mo.

BALL JOINT BOOKLET — "Recommended Practices for Lubricating Passenger Car Ball Joint Front Suspensions." The latest aid in application, created by experts in the field and designed for use in the station. Twelve pages, easy to read, with large illustrations throughout. Twenty-five cents a copy with quantity discounts—company imprint arranged.

NLGI MOVIE — "Grease, the Magic Film," a 16-mm sound movie in color running about 25 minutes, now released. First print $300, second and subsequent orders $200 each (non members add $100 to each price bracket).

WHEEL BEARING MANUAL — "Recommended Practices for Lubricating Automotive Front Wheel Bearings." More than 170,000 copies of this booklet have been distributed throughout the world. Now in its sixth printing. Sixteen pages, with more than 40 illustrations. Twenty-five cents a copy, with quantity discounts — company imprint arranged.

BONER'S BOOK—Manufacture and Application of Lubricating Greases, by C. J. Boner. This giant, 982-page book with 23 chapters dealing with every phase of lubricating greases is a must for everyone who uses, manufactures or sells grease lubricants. A great deal of practical value. $18.50, prepaid.

and especially...

WEST

PETROLEUM MARKETERS, the world over, seeking a new, competent and qualified source of supply for their lubricating grease requirements look to Battenfeld. On the West Coast, they are finding that products manufactured by Battenfeld of California answer their demands for Quality, Service and Performance.

As an example . . . in the great Pacific northwest, you hear the expression . . . "Make 'er hell for stout" . . . it's the logger's way of saying he wants equipment that will stand up to his work . . . the toughest harvesting job on earth . . . that of cutting and hauling more than 16 billion board feet of timber each year.

Lubricants manufactured by Battenfeld of California helps him keep his equipment "stout" . . . helps prevent costly breakdowns by cushioning bearing surfaces against terrific grinding pressures.

At Battenfeld of California, grease is not just "grease." Each lubricant manufactured has its own special molecular structure . . . one which enables it to fulfill its own specific job requirements.

We at Battenfeld make readily available to you, the wealth of experience accumulated and put to use over a period of forty-one years, experience in the form of lubricants carefully compounded for your type of equipment . . . experience obtained from an ever increasing research program dedicated to solving the lubrication problems of modern industry.

Whether you market North, South, East or West, look to Battenfeld for leadership. Where freight and geographical location demands a West Coast source . . . let Battenfelds California plant counsel with you on your requirements. Write:

Battenfeld Grease & Oil Corp.
19530 South Alameda Road
Compton, California

THE Battenfeld GREASE & OIL CORP., Inc. Kansas City, Mo. • Minneapolis, Minn. • Compton, Calif.

LABORATORY REPORT

Testing proves Baragel and Baragel* 24 grease effectiveness*

BARAGEL grease tests being conducted continuously

Tests are constantly being conducted using BARAGEL and BARAGEL 24 in greases made from both petroleum and non-petroleum base oils. The greases are formulated from refined oils of varying viscosities with selected dispersion aids.

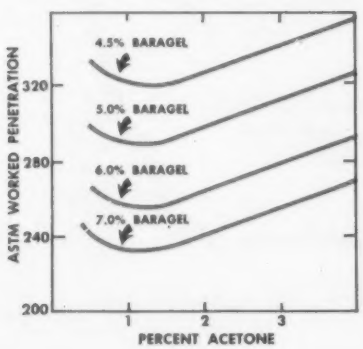
BARAGEL and BARAGEL 24 are versatile, non-soap grease gelling agents consisting of mixed organic ammonium halides and refined sodium montmorillonite. Test results are available in printed form. If you are not already on the mailing list, you can obtain Data Sheets by writing Baroid Chemicals, Inc.

BARAGEL very versatile in greases made with oils of varying viscosity indexes

BARAGEL is considerably more efficient than BENTONE* 34 in greases compounded with solvent refined, high VI oils. Greases having an ASTM worked penetration in the 315 range require about 4.5% BARAGEL compared to a BENTONE 34 requirement of about 5.75%.

BARAGEL has also proved to be efficient in greases compounded with conventionally refined oils of relatively low viscosity index. Tests were made with a base oil of 21.5° API gravity and a viscosity of 517 SUS at 100° F.

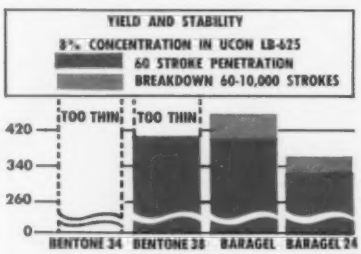
BARAGEL was stirred into the oil, acetone added and stirred, and the mixture was milled. Greases having an ASTM worked penetration in the 315 range required about 4.5% BARAGEL, while greases in the 280 range required about 5.5% BARAGEL. Data Sheet A-3, available on request, gives full details of this test.



Greases made with Ucon LB-625

BARAGEL 24 is more efficient in thickening Ucon LB-625 than are BENTONE 34, BENTONE* 38 and BARAGEL. BARAGEL 24 greases are also more stable to working in the ASTM grease worker.

In a series of tests, the gelling agents were stirred into the Ucon LB-625, propylene carbonate was added, heat applied, and the mixture was milled. The chart above compares the results of thickening greases with BENTONE 34, BENTONE 38, BARAGEL and BARAGEL 24. Full details of these tests are available in Data Sheet A-1.

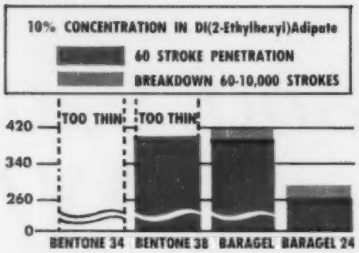


The worked penetration of a grease made from Ucon LB-625 and 8% BARAGEL 24 was 315, with a penetration of 355 after working 10,000 strokes.

BARAGEL 24 efficient in greases made with Di(2-Ethylhexyl) Adipate

BARAGEL 24 has been proved by tests to be particularly efficient in thickening greases made with Di(2-Ethylhexyl) Adipate. Greases prepared with BARAGEL 24 are also much more stable to working in the ASTM grease worker.

Tests were made to compare results when thickening greases with BENTONE 34, BENTONE 38, BARAGEL and BARAGEL 24. The results are shown in the accompanying chart and details are available in Data Sheet A-2.

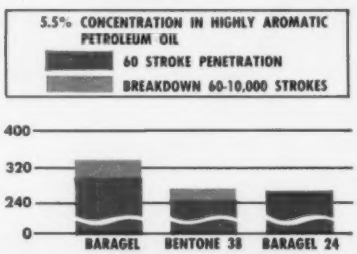


Greases made with Di(2-Ethylhexyl) Adipate and 10% BARAGEL 24 showed worked penetrations of 260. After working 10,000 strokes, these same greases showed a penetration of only 290.

BARAGEL 24 in grease made with petroleum oil

In a particular petroleum oil of high aromatic content (28%), BARAGEL 24 produces a grease completely stable to working in the ASTM grease worker over the range of unworked to 10,000 strokes.

In a series of tests, the oil used had an API gravity of 16.9° at 60° F and a viscosity of 309 SUS at 100° F. The worked penetration was 265 when 5.5% BARAGEL 24 was used. Comparisons of penetration when using the same per cent of BENTONE 34 and BARAGEL are shown on the accompanying chart. Full details are available in Data Sheet A-4.



BAROID

BAROID CHEMICALS, INC.

A SUBSIDIARY OF NATIONAL LEAD COMPANY
909 SOUTH COAST BUILDING
HOUSTON 2, TEXAS

*Trademark of National Lead Company for an organic ammonium montmorillonite.

Future Meetings

MAY, 1960

9-12 API Division of Refining Midyear Meeting, Statler and Sheraton-Cadillac Hotels, Detroit.

16-17 API Division of Marketing, lubrication committee meeting, Bedford Springs Hotel, Bedford Springs, Pa.

18-20 API Division of Marketing Midyear Meeting, Statler-Hilton Hotel, Cleveland

JUNE, 1960

5-10 Society of Automotive Engineers, summer meeting, Edgewater Beach Hotel, Chicago

SEPTEMBER, 1960

11-16 American Chemical Society, 138th National Meeting, headquarters undecided, New York.

14 API Division of Marketing, lubrication committee meeting, Hotel Traymore, Atlantic City, New Jersey.

14-16 National Petroleum Association Annual Meeting, Hotel Traymore, Atlantic City, New Jersey.

18-20 IOCA 13th Annual Meeting, Hotel Moraine, Highland Park, Ill.

18-21 ASME Petroleum Mechanical Engineering Conference, Jung Hotel, New Orleans.

OCTOBER, 1960

3-4 ASLE 7th Lubrication Conference, Hotel Morrison, Chicago.

17-19 ASME – ASLE Lubrication Conference, Statler Hilton Hotel, Boston.

OCT. 30-NOV. 1 NLGI Annual Meeting, Edgewater Beach Hotel, Chicago

NOVEMBER, 1960

2 Packaging Institute, petroleum packaging committee meeting, headquarters undecided, New York.

3-4 SAE National Fuels and Lubricants Meeting, Mayo Hotel, Tulsa, Okla.

14-16 API 40th Annual Meeting, Conrad Hilton, Palmer House and Congress Hotels, Chicago.

27-Dec. 2 ASME Annual Meeting, Statler Hilton Hotel, New York.

JANUARY, 1961

9-13 Society of Automotive Engineers Annual Meeting, Cobo Hall and Convention Arena, Detroit.

ADVANTAGES of membership in the National Lubricating Grease Institute

Some of the membership advantages are listed below:

- The NLGI represents over 95 per cent of the lubricating grease industry with members in this country and overseas.
- NLGI has a Technical Committee of 154 members which is divided into nine sub-committees working constantly on industry problems.
- The NLGI SPOKESMAN, a monthly technical journal, is mailed free of charge to key personnel within a member firm. If extra copies of the magazine are needed, they may be purchased at half the regular subscription price.
- The Institute works in close cooperation with affiliated groups including SAE, ASTM, ASA, ASLE, ASME, SAE-Cimtc and IOCA on problems and accomplishments in the lubricating field.
- The main objectives of the National Lubricating Grease Institute are for the development of better lubricating greases for the consumer and better grease lubrication engineering service to industry.

If your firm is interested in becoming affiliated with NLGI, the national office will be happy to furnish further information concerning the organization. Just as 1959 was a banner year for NLGI accomplishments 1960 promises to be even better with more scope and more member advantages.

NLGI 1959 Production Survey Shows Gain in Pounds Produced

The NLGI production survey continues to grow. That is the first fact noted in the latest release of data on production of lubricating greases and fluid gear lubricants in the United States and Canada. Not only is the total pounds produced figure up an impressive amount but more companies are reporting, as shown in the latest compilation—on 1959 production.

Officially known as the Production Survey Report, this is the third such gathering sponsored by NLGI, based on production in pounds during the calendar year. The latest . . . the 1959 survey, was just released to all four (Active, Associate, Marketing and Technical) membership classifications of the Institute in mid-April.

The comparative data for the three years—1957, 1958, and 1959, and the accompanying three percentages of production figures offer an excellent historical concept on production of six soap types. As envisioned earlier by the Board of Directors, the survey is beginning to delineate trends. Pending the regular analysis by the chairman of the Survey Committee, the journal can only report that in addition to an increase of pounds produced, participation is increasing at an excellent rate by member companies . . . 80 per cent for both countries.

This would break down to one hundred per cent return for the six Canadian firms polled, which also occurred last year when Dominion members first began participating in the 1958 survey.

United States firms showed a 4.5 per cent reporting increase. Three more companies reported 1959 data, making a total of 50 U. S. firms and a 78.13 per cent total U. S. figure . . . the highest yet.

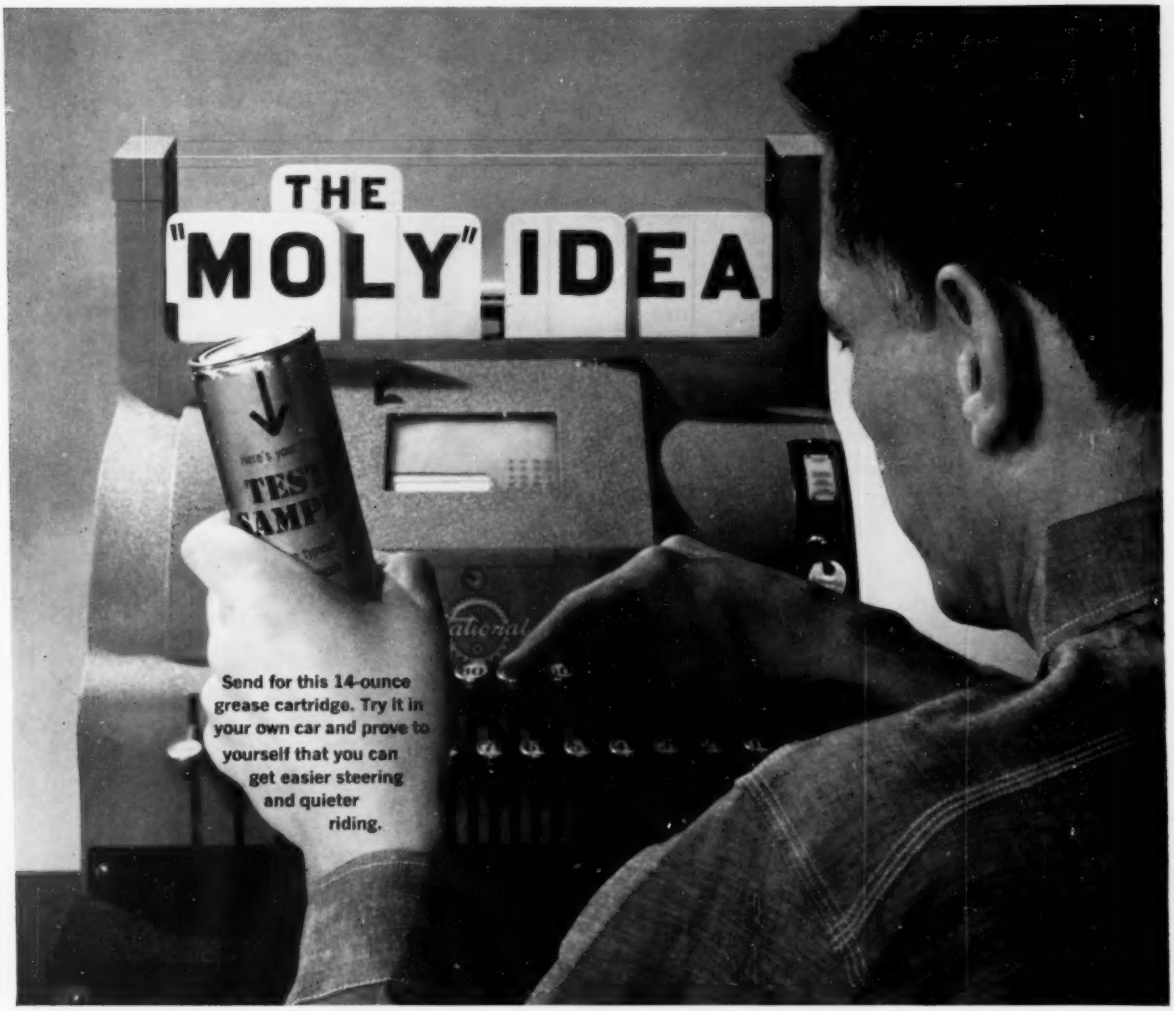
Unofficial estimates placed the NLGI production totals at more than 85 per cent of total U. S. production in the 1957 and 1958 surveys. The analysis may peg this figure even higher because of the increased representation.

NLGI's survey is conducted by the management services division of Ernst & Ernst, national public accounting firm, on a basis laid out and approved by Institute Active (manufacturing) members. Survey forms are sent to all Actives in mid-January and replies are anonymous . . . no firm may be identified. The cut-off date is March 31 of each year and once totalled, the information is then mailed to all members by mid-April. An analysis is offered in the NLGI Spokesman later in the year.

Non-member firms may obtain the data by writing the national office and paying the sum of ten dollars.

SIGN OF
CORRECT LUBRICATION
Mobil
Makers and Marketers of
Mobil Automotive
Products
Mobil Industrial
Oils and Greases
150 E. 42nd STREET
NEW YORK 17, N. Y.

LUBRICATING GREASES • METALWORKING LUBRICANTS • SPECIAL PROCESS OILS
BEMOL
BEMOLybdenum
Fortified Lubricants
mbi
ON GUARD SINCE 1888
Never Underestimate the Importance of Protective Lubrication
MAGIE BROS. OIL CO.
Franklin Park, Illinois • Chicago Phone TU 9-4800


THE
"MOLY" IDEA
Send for this 14-ounce grease cartridge. Try it in your own car and prove to yourself that you can get easier steering and quieter riding.

Grease sells gasoline!

Grease can increase service station traffic and sales. Grease can sell gasoline! • That's the "MOLY" IDEA. • And it works.

Oil marketers have tried it. They've recorded increases in service station, in traffic, gas sales, grease sales, and TBA sales. So they've repeated it. And made "MOLY" grease their standard product.

Why does it work?

Because smart marketers know that a new product is their big opportunity for dramatic promotion. The new product is their own brand grease with Molysulfide added, giving them the first grease in years they can talk about and promote . . . the lube job a customer can appreciate with his hands, his ears, and his pocketbook. Because "Moly" grease makes steering easier, riding quieter, and it reduces wear. Most important . . . you can translate these technical benefits into your customer's language!

Have you looked into the sales potential of the "MOLY" IDEA? Have you counted up the benefits to your company, your dealers, and your customers? Have you thought about the opportunities for local promotion and increased traffic that this new grease can give you? If not, remember: "Moly" grease has grown faster than any other product in the history of the grease industry. You can profit by this growth.

We'll be happy to send you the facts. Write for details supporting THE "MOLY" IDEA, to Climax Molybdenum Company, a Division of American Metal Climax, Inc., 1270 Avenue of the Americas, New York 20, N. Y.

CLIMAX MOLYBDENUM COMPANY

A division of American Metal Climax

1270 Avenue of the Americas, New York 20, N. Y.

Baker does it all

There's no middle man in the picture when you buy your hydrogenated castor oil derivatives from Baker. Because, from selection of the raw castor beans to production of the finished chemicals, Baker does it all.

This integrated operation assures you of uniform quality and steady supply of Baker's Castorwax® hydrogenated castor oil, hydroxystearic acid, and methyl hydroxystearate. It also means that by the bag or carload, Baker—the world's largest and most experienced producer of castor oil derivatives—is your prime source of supply.

Let us fill your next requirement. We will deliver what you need when you want it. Baker plants at Bayonne and Los Angeles, offices and warehouses in principal cities.

7401-A

the **Baker** castor oil company
ESTABLISHED 1857
BAYONNE, NEW JERSEY

A Review of NLGI's Tentative Dispensing Method

Presented at the NLGI 27th annual meeting in New Orleans, October, 1959

By:
R. D. Skoglund
Texaco, Inc.

WHEN SELECTING a grease to be used in a dispensing system, there are two very important considerations: the quality of the grease and the pumpability characteristics. There are many laboratory tests which can be used satisfactorily to provide an indication of how a grease will perform in service. Tests evaluating such properties as anti-wear, extreme pressure, rusting, water resistance, etc., do provide, for the most part, understandable results for predicting how a grease will perform. Such data can be discussed intelligently between the grease manufacturer and customer.

As far as grease pumpability is concerned, however, there has not been an entirely satisfactory means of communication for discussing expected performance. The pump manufacturer or his customer will ask the grease company, "Will my dispensing pump handle your grease?" The grease company in return will ask, "What are the requirements of your system and how heavy a grease can you handle?"

While both the pump manufacturer and grease company often have their own methods for determining the performance of their products, there usually is no satisfactory way to compare the values that are obtained.

An NLGI Subcommittee on Delivery Characteristics of Dispensing Equipment for Lubricating Greases has for many years been working on a practical test method which would help solve some of these difficulties. A tentative method was published in 1955* which was a step in the right direction. In essence, this method related results obtained in the pressure viscometer, standard equipment in many laboratories, to actual performance data determined for a grease in a service station type air-operated dispensing system. The results were expressed in terms of an NLGI limiting apparent viscosity value. This value could be used to determine the lowest temperature a given pump-grease combination would be expected to yield two ounces per minute delivery. The latest NLGI method is generally the same except that the scope of the method has been expanded to describing the entire pump delivery curve as a function of apparent viscosity data.

History

The mechanics of the latest method will be discussed, but first it may be well to review briefly some of the historical background for this method. The NLGI Subcommittee on Delivery Characteristics of Dispensing Equipment was formed in 1946.

After defining the problems involved, a test method was decided upon and a cooperative test program was established. Representatives of manufacturers of

*This method is shown in the September, 1955 issue of the NLGI SPOKESMAN.

grease dispensing equipment and lubricating greases generously contributed time, ideas and equipment to complete this assignment.

Five greases were tested in the cooperative program. The results of this work formed the basis for the original NLGI tentative method.

Several other points appeared worthy of investigation so further cooperative work was undertaken. The original method was limited to a dispensing pump discharge hose length of ten feet maximum. Since most service stations used long lengths of hose in their permanent installation, it was felt that this effect should be checked. Tests were run using a hose length of 55 feet as well as comparative tests using hose lengths of seven and twenty feet. It was also thought that it would be preferable to have a standardized oil for a calibration fluid rather than a grease when determining the pumping characteristics of a dispensing system. Some of the results obtained in the cooperative program to investigate these points are as follows:

1. As expected, lower outputs were obtained in the long hose than in the short hose for a given lubricant.

2. A comparison of test results obtained with the long hose vs. the short hose equipment showed a reversal in relative pumpability for the two different soap base greases tested.

3. Using an oil to calibrate a grease pump and then predicting grease flow rates from oil and grease viscosity vs. temperature data was not an accurate procedure.

Discussion of NLGI Tentative Dispensing Method

This method describes a procedure for relating apparent viscosity of lubricating greases with delivery characteristics of air-operated automotive grease dispensing pump systems. It consists of three parts. The complete method is included herewith. An outline of the method is shown in Figure 1.

Part I

For the first phase of the test method a pump manufacturing company selects a conventional automotive grease and evaluates it in his dispensing pump. The complete dispensing system consists of (1) a compressed air source, (2) an air dryer, (3) a surge tank, (4) a cold room or refrigerated box, (5) the dispensing pump to be tested and (6) the dispensing hose, control valve and restrictor.

Pumping determinations are made at approximately 70°F. and a minimum of two lower temperatures. An air pressure of 90 psi is recommended. Other pressures can also be used. At each temperature the grease is pumped a prescribed number of cycles, collected and weighed to determine the delivery rate in ounces per minute. The cycles per unit time will decrease as the temperature is lowered. The output per cycle should remain constant, however, and if it decreases at low temperature by 25 per cent or more, it is an indication that cavitation is too severe for an accurate evaluation of the dispensing equipment.

A restrictor is required to simulate back pressures produced by tight automotive fittings. Tests made without a restrictor do not simulate field conditions and the deviation is so great that results obtained would be misleading.

The delivery rates obtained are plotted as a function of apparent viscosity at 200 sec.$^{-1}$. The apparent viscosity values are obtained from a temperature vs. viscosity chart (the procedure for determining this relation will be explained in Part II) for the grease under test.

Part II

Apparent viscosity results described in this part of the method are normally obtained by the grease manufacturing company. Apparent viscosity data are determined in a pressure viscometer, a standard piece of laboratory equipment. The testing method is essentially ASTM D 1092-58. In this apparatus a grease sample is forced through a capillary by means of a floating piston actuated by a hydraulic system. Viscosity determinations can be made over a wide range of shear rates by the use of different size capillaries. For the NLGI Method, however, only a shear rate of 200 reciprocal seconds is used since it was found to correlate with service.

To obtain the desired data for this part of the method, capillaries and gear ratios in the pressure viscometer apparatus are selected which give approximately the desired value of 200 sec.$^{-1}$ shear rate. Runs are made at several different temperatures. Sufficient data are obtained so that the final results can be shown as a plot of apparent viscosity at a shear rate 200 sec.$^{-1}$ as a function of temperature.

Part III

The delivery rate to be expected for a given pump system and grease at any temperature and air pressure or the temperature for a given flow rate can be predicted by combining the results obtained in Part I and Part II.

From the pump performance curves, a delivery rate at any air pressure investigated can be related to an apparent viscosity value. The intersection of this value on the Apparent Viscosity vs. Temperature curves obtained by various grease manufacturers for their greases will determine the predicted temperature for the delivery rate.

Predicted pumpability data will be the most reliable when the Apparent Viscosity at 200 sec.$^{-1}$ vs. Temperature curves for the grease of interest have the same general slope as the grease actually used in determining the performance curves in the dispensing system setup.

Present Status of Method

Four different soap base greases have been tested by this method. Included have been lithium, sodium, calcium and aluminum soap greases of NLGI No. 1 and 2 grades. A comparison of predicted performance from the Apparent Viscosity at 200 sec.$^{-1}$ vs. Temperature curves for these greases to actual data in the dispensing system was very good. Cooperative work may be necessary along with continued experience using this new method to fully determine its usefulness. At the present time, however, it appears that the new method provides a satisfactory means of determining pumpability characteristics of greases.

Acknowledgment

As mentioned previously, work done on this method was a cooperative effort among many individuals and companies. The following lists all members and their company affiliation at the time work was being done who have served on this Committee either as members or alternates.

T. G. Roehner, Socony-Mobil Inc., *Chairman, Technical Committee* (1947-59)
L. C. Brunstrum, Standard Oil (Indiana), *Chairman*, 1946-50)
N. Marusov, Gulf Research & Development, *Chairman*, (1951-56)
G. Kaufman, Texaco, *Present Chairman*
R. G. Moyer, Pure Oil, *Chairman, Sub-group on Slumpability*
Earl Arnott, Union Oil
W. J. Backoff, Pure Oil
R. S. Barnett, Texaco
B. A. Beaver, Gray Company
Roy H. Bleikamp, Lincoln Engineering
C. J. Boner, Battenfeld Grease & Oil (K. C.)
E. S. Carmichael, Socony-Mobil Oil
J. F. Carter, Aro Equipment
E. W. Cave, Continental Oil
W. Couch, Aro Equipment
George Entwistle, Sinclair Refining
H. A. Erickson, D. A. Stuart Oil
R. P. Field, Balcrank
E. D. Fox, Balcrank
W. L. Gabbert, Lincoln Engineering
E. J. Gesdorf, Farval
N. J. Gothard, Sinclair Refining
W. L. Hayne, Standard Oil (Indiana)
H. L. Hemmingway, Pure Oil
H. L. Hendricks, International Lubricant
M. H. Kvaal, Gray Company
W. C. Leitch, Aro Equipment
H. J. Liche, Standard Oil (Indiana)
P. R. McCarthy, Gulf Research and Development
L. W. McLennan, Union Oil
H. A. Murphy, Gray Company
E. W. Nelson, Continental Oil
W. H. Oldacre, D. A. Stuart Oil
D. C. Peterson, Stewart-Warner
R. L. Pontious, Sinclair Refining
C. F. Raisch, Stewart-Warner
D. G. Reed, Aro Equipment
R. C. Robinson, Socony-Mobil Oil
L. C. Rotter, Lincoln Engineering
R. D. Skoglund, Texaco
K. E. Snow, Texaco
R. F. Strohecker, Texaco
R. A. Stunkel, Lincoln Engineering
F. A. Suess, Continental Oil
H. R. Tear, Stewart-Warner
G. A. Williams, Battenfeld Grease & Oil
F. E. Woodward, Chemical Laboratory, Rock Island Arsenal

NLGI Tentative Method for Matching Lubricating Grease Flow Properties with Lubricating Grease Dispensing Pump Delivery

SCOPE

This method describes a procedure for relating apparent viscosity data of lubricating greases with delivery characteristics of air-operated automotive grease dispensing pump systems.

Part I—Test method for measuring dispensing characteristics of an air-operated pump coupled with a dispensing line and standard NLGI restrictor.

Part II—Test method for determining the relationship between the apparent viscosity of lubricating greases at a rate of shear of 200 sec.$^{-1}$ vs. temperature.

Part III—Procedure for combining the results obtained in Part I and II to enable prediction of flow properties of lubricating greases in the dispensing pump system.

DEFINITIONS

1. Apparent Viscosity: The ratio of shear stress to rate of shear of a non-Newtonian fluid, calculated from Poiseuille's equation and measured in poises. (Changes with changing rates of shear and temperature, and must therefore be reported as the value at a given shear rate and temperature).

2. Rate of Shear: Determined as $\frac{4Q}{\pi R^3}$ where: Q= volume rate of flow and R is the radius of the capillary.

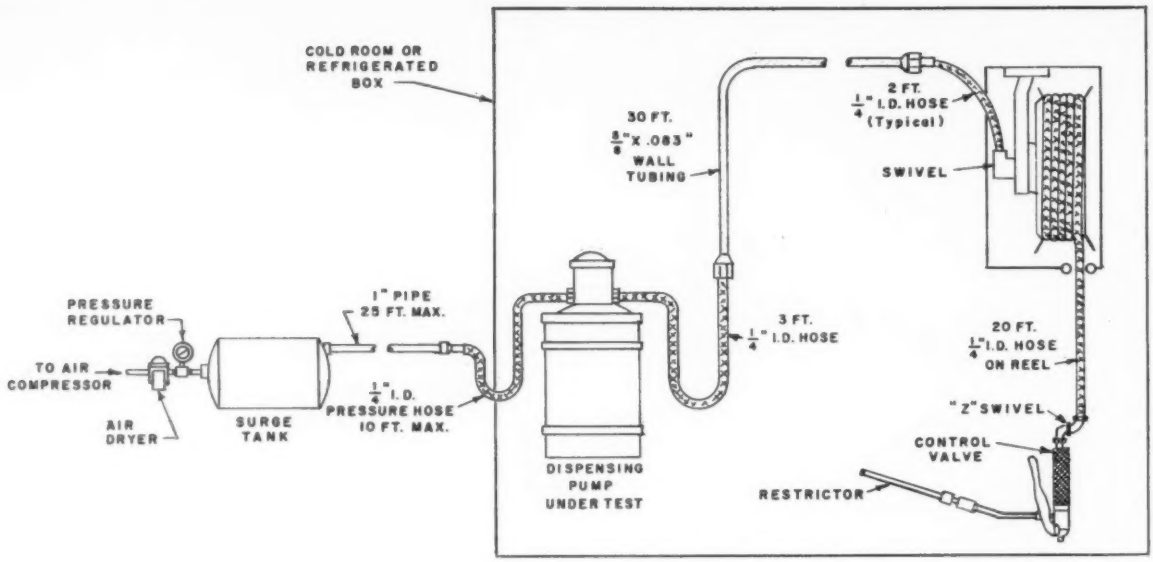


FIGURE 1—Test assembly for determining the delivery characteristics of pumps.

(Note: Because Poiseuille's equation does not strictly apply to non-Newtonian materials, rate of shear and viscosity measurements of lubricating greases are merely apparent values).

3. Shear Stress: Shearing force (pressure x circular area) divided by the shear area (circumference x length) which, for circular conduits, reduces to $\frac{PR}{2L}$

where: P = applied pressure, R = radius, L = length.

4. Dispensing Pumps: Air-operated lubricating grease dispensing pumps as used for automobiles, trucks, buses, etc.*

5. Lubricating Greases: Conventional automotive chassis lubricants have proven satisfactory in this method.

6. Capillary: A right cylindrical tube having a length to diameter ratio of 40:1.

7. Cavitation: Reduction of delivery per stroke (compared with delivery per stroke obtained at temperatures between 70°F. and 80°F.).

8. Soaking: Maintaining the entire assembly at constant temperature.

Part 1 — Delivery Characteristics of Dispensing Pump Systems

OUTLINE OF METHOD

All tests are made with unworked and unused lubricating grease. The delivery rates of the dispensing pumps are established at a minimum of three temperatures, one temperature between 70°F. and 80°F., one between 40°F. and 50°F., and one at which the delivery will be less than two ounces per minute.

Delivery rate is plotted as a function of apparent viscosity on semi-log coordinates.

APPARATUS

The following equipment is to be assembled in the order shown in Figure 1:

1. Compressed air source capable of supplying a pressure of at least 90 psi and means for maintaining test pressures within ± 2 psi.

2. Air dryer of optional design; may be a separate unit or included in the surge tank.

3. Surge tank having a minimum capacity of 30 gallons equipped with a pressure gage and connected to the equipment in the cold room by not more than 25 feet of one-inch pipe and ten feet of ¼ inch I.D. pressure hose.

4. A cold room or refrigerated box capable of holding the test temperature within a maximum deviation of ± 2°F. for a period of four days, and large enough to contain the pump, hose, control valve, and restrictor.

(Note: All necessary operations are made without exposing any portion of the equipment under test to any temperature except test temperature).

5. Dispensing pump to be tested.

(Note: Limiting dispensing value applied to pump

*The results found by this method may not be valid for other types of pumps and/or longer hose lengths or restrictor owing to a possible significant change in the effective rate of shear.

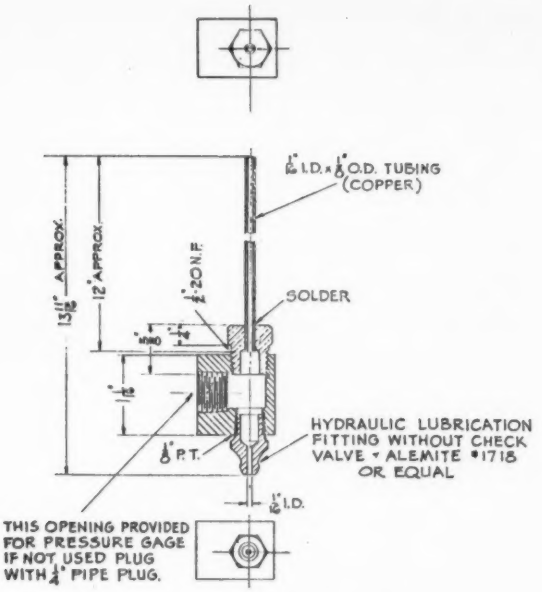

1/2" I.D. x 3/8" O.D. TUBING (COPPER)
SOLDER
HYDRAULIC LUBRICATION FITTING WITHOUT CHECK VALVE - ALEMITE #1718 OR EQUAL
1/8" P.T.
1/2" I.D.
THIS OPENING PROVIDED FOR PRESSURE GAGE IF NOT USED PLUG WITH 1/4" PIPE PLUG.
APPROX.
APPROX.
20 N.F.

FIGURE 2—Restrictor for NLGI grease flow test.

as tested. Changes in hose length, number of swivels, design of control valve, etc., alter the delivery rate. For standardization, the lubrication of the air motor during test must comply with the manufacturers' recommendations included in sales and service manuals).

6. Restrictor as shown in Figure 2.

SAMPLE

One or more samples of grease in original packages suited to the equipment to be tested.

(Note: If follower plates are included in the packages they should be removed).

PROCEDURE

Assemble the apparatus and mount a thermocouple one inch from the side and flush with the bottom of the pump inlet. (Note: The end of the thermocouple should be firmly mounted to prevent its passing into the pump inlet port). The temperature at this point is used in all subsequent instructions.

1. Attach the NLGI restrictor and allow the assembled equipment and lubricating grease to come to test temperature and then "soak" at the test temperature 72 hours before making a test. Start at some convenient temperature between 70°F. and 80°F.

2. Adjust air pressure for 90 psi.

3. Operate the equipment for 30 seconds but do not retain the grease that is delivered. Immediately thereafter, operate the gun for 50 cycles and collect the grease. Record the elapsed time, weight of product delivered, and the temperature indicated by the thermocouple.

(Note: Should the gun run too fast at 70°F. to permit an accurate count of the number of cycles, the high temperature test may be made at a lower temperature).

4. Wait five minutes and repeat operation (3) in its entirety. Wait another five minutes and repeat it again.

5. Repeat items 2, 3, and 4 at a minimum of two lower temperatures with a minimum "soaking" period of 72 hours at each temperature.

The following temperatures and number of cycles at each temperature are suggested:

(80°F.-70°F.)-50 cycles
(50°F.-40°F.)-25 cycles
(32°F. or any temperature required for less than 2 ounces per minute delivery)-10 cycles

(Note 1: It is not important that test be made at specific temperatures, however, the temperature used should be known with a precision of ± 0.5°F.).

(Note 2: To estimate temperatures required to give deliveries less than two ounces per minute, plot on log-log coordinates the results obtained at the two higher temperatures. Extrapolation of the diagram will approximate the value of the low temperature).

(Note 3: If it is not possible to complete test at low temperature because of cavitation, the entire test should be re-made with a non-cavitating grease).

To establish delivery characteristics of pump systems for other pressures in addition to 90 psi, adjust pressure to desired value and repeat items 3, 4, and 5 in their entirety.

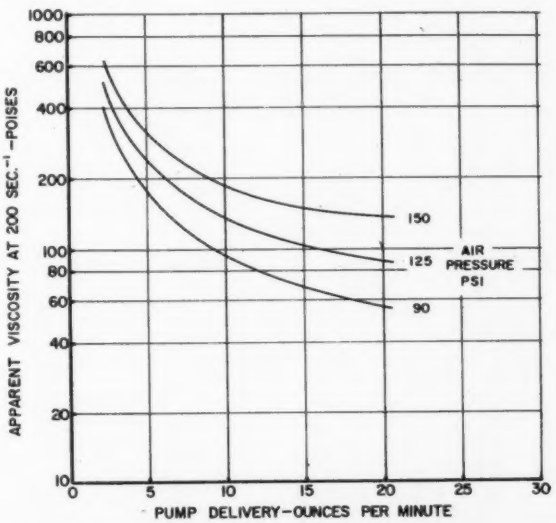
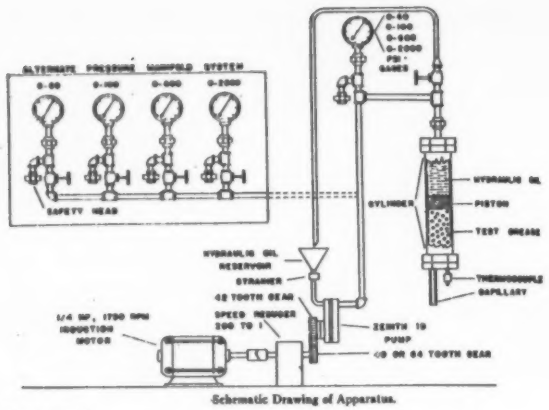


FIGURE 3—PART I. Pump delivery vs. apparent viscosity at 200 sec.$^{-1}$



Schematic Drawing of Apparatus.

FIGURE 4.

CALCULATIONS

Calculate and list the following as shown in Table 1:

a. Delivery per cycle=$\frac{\text{delivery weight per test}}{\text{number of cycles per test}}$

b. Delivery per minute=$\frac{\text{delivery weight per test}}{\text{test time in minutes}}$

c. Apparent viscosity at shear rates of 200 sec.$^{-1}$ at each test temperature-Obtained from temperature-viscosity chart or as indicated in Part II.

d. Plot on semi-log coordinates (Figure 3)-Delivery in ounces per minute as a function of apparent viscosity.

(Note: Where cavitation greater than 25 per cent is obtained, the test points should not be used for this standardization. Under conditions of cavitation, erratic deliveries may be observed).

Part II—Determination of Apparent Viscosity Characteristics of Lubricating Greases

OUTLINE OF METHOD

The apparent viscosity is determined in a pressure viscometer, in which a sample of the grease is forced through a capillary by means of a floating piston actuated by a hydraulic system. From the predetermined flow rate and the force developed in the system, the apparent viscosity is calculated by means of Poiseuille's equation. Only one capillary and two gear ratios are needed. The capillary is of such radius that with one of the gears supplied with the apparatus, the shear rate will be nearly 200 sec.$^{-1}$.

(Note: For detailed description of the instrument and its calibration, refer to ASTM Standard Method of Test for Apparent Viscosity of Lubricating Greases, ASTM Designation: D-1092-58).

APPARATUS

1. ASTM Viscometer and auxiliary equipment. (See Figure 4). (Reference-ASTM Method 1092-58).

2. A cooling compartment of optional design capable of maintaining temperatures within ± 1°F. for four hours and large enough to contain the grease cylinder during measurement.

PROCEDURE

1. Charge the grease cylinder, excluding air.

2. Fill the entire hydraulic system completely with hydraulic oil. To insure complete filling, with the entire viscometer assembled, circulate the hydraulic oil

TABLE 1

Sample Data Sheet to Determine Dispensing Characteristics of Lubricating Grease Dispensing Pumps Restricted Flow—90 P.S.I. Air Pressure

Temp. °F.	*Cycles Per Test*	*Total Test Time Minutes*	*Wt. of Grease Dispensed Ounces*	*Delivery per Cycle Ounces*	*Delivery oz./min.*	*Average Delivery oz./min.*	*Apparent Viscosity Poises*
79	50	1.53	29.8	.596	19.5		
79	50	1.52	30.1	.602	19.8		
79	50	1.52	29.8	.596	19.5	19.6	57.5
60	40	2.75	23.3	.583	8.47		
60	40	2.78	23.5	.587	8.46		
60	40	2.82	23.5	.587	8.32	8.42	109
45	25	3.94	14.8	.593	3.75		
45	25	3.74	14.8	.593	3.96		
45	25	3.58	14.8	.593	4.13	3.95	222
32	10	4.76	6.00	.600	1.26		
32	10	4.33	5.80	.580	1.34		
32	10	4.10	5.90	.590	1.44	1.35	508

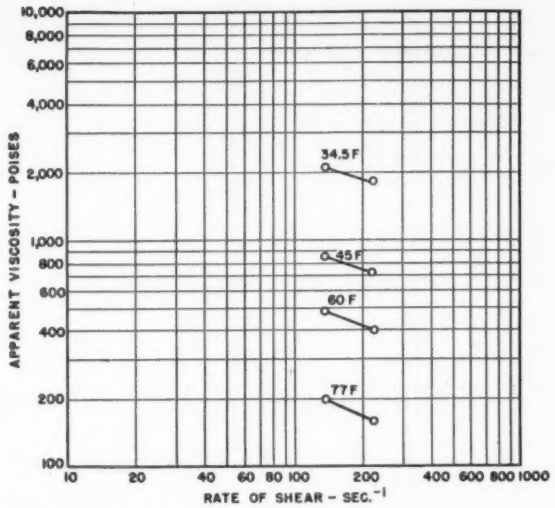


FIGURE 5—PART II. Apparent viscosity as a function of rate of shear and temperature.

with the return valve open until any trace of air is eliminated.

(Note: The hydraulic oil should have a viscosity of 2000 centistokes at the Zenith Pump temperature).

3. With the entire hydraulic system connected and completely filled with hydraulic oil and test grease, adjust the temperature to the desired value and maintain for a period of four hours.

Use a capillary that will give approximately the desired value of 200 sec.$^{-1}$ rate of shear. Operate the pump with the return valve closed until equilibrium pressure is obtained. Record the pressure. Change gears and establish the second equilibrium pressure. Record the second pressure.

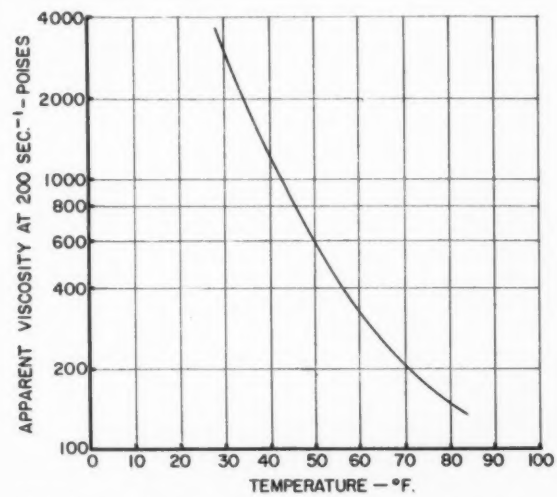


FIGURE 6—PART II. Apparent viscosity as a function of temperature.

CALCULATIONS

a. Calculate the apparent viscosity in poises of the grease as follows:

η = apparent viscosity = F/S

Where: F is the shear stress and S is the shear rate, therefore:

$$\eta = \frac{F}{S} = \frac{\frac{P\pi R^2}{2\pi RL}}{\frac{4Q}{\pi R^3}} = \frac{P\pi R^4}{8LQ} = \frac{P69{,}000\pi R^4}{8LQ}$$

Where: P = Observed pressure, psi

69,000 = Numerical conversion from pounds per square inch to dynes per square centimeter

R = Radius of the capillary-cm

$$Q = \frac{V}{t} = \frac{\text{Volume}}{\text{Time}} = \text{flow rate} = \frac{\text{milliliters}}{\text{seconds}}$$

b. Calculations may be reduced by preparing a table of constants for each of the two capillary and gear combinations. The calculations then involve:

$$\eta = \frac{P(\text{Observed})\ 69{,}000\pi R^4 \text{ or } PK}{8LQ}$$

Where: $K = \frac{69{,}000\pi R^4}{8LQ}$

c. Plot apparent viscosity vs. shear rate (see Figure 5) and interpolate or extrapolate the apparent viscosity at 200 sec.$^{-1}$.

d. Plot apparent viscosity at 200 sec.$^{-1}$ rate of shear as a function of temperature on semi-log coordinates (see Figure 6).

(Note: Several curves may be illustrated on the same sheet).

Part III—Application of Results Obtained From Part 1 and Part II

OUTLINE OF METHOD

The delivery rate to be expected for a given pump system and grease at any temperature and air pressure or the temperature for a given flow rate can be predicted. This is done by comparing 200 sec.$^{-1}$ apparent viscosity vs. temperature curves for greases of interest with the chart showing delivery rate as a function of apparent viscosity at 200 sec.$^{-1}$ for the pump system.

PROCEDURE

1. Obtain the apparent viscosity value of the grease dispensing equipment for a particular flow rate and air pressure from Figure 3.

2. Establish the point of intersection of the apparent viscosity value of the pump and the apparent viscosity curve in Figure 6.

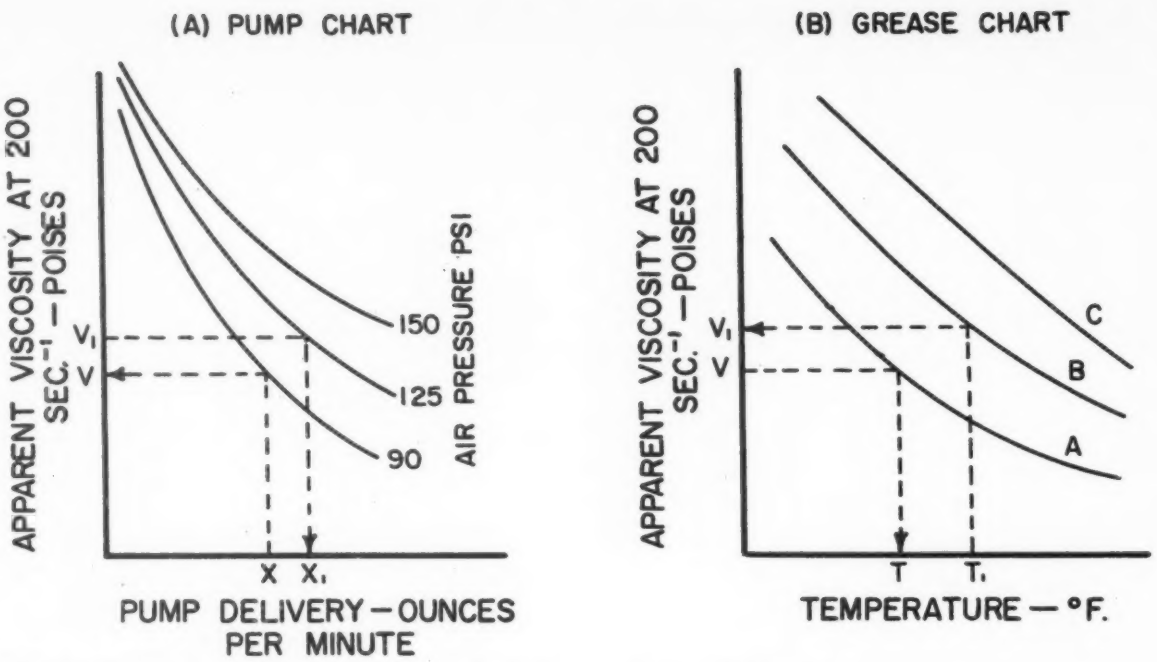


FIGURE 7—PART III. Example of combining results obtained in PART I and PART II.

3. The reverse procedure in Steps 1 and 2 above can be followed.

EXAMPLE

1. Determine the predicted temperature at which Grease A shown in Figure 7(b) will deliver X ounces per minute at 90 psi air pressure.

Solution—From pump performance curves shown in Figure 7(a), find intersection of X ounces per minute on the 90 psi air pressure delivery curve. An apparent viscosity value of V is obtained.

In figure 7(b), the intersection of apparent viscosity value V with curve for Grease A gives predicted temperature of T.

2. Determine the predicted delivery rate of Grease B shown in Figure 7(b) at T_1 °F. and 125 psi air pressure.

Solution—Find intersection of T_1 on curve for Grease B in Figure 7(b). An apparent viscosity value of V_1 is obtained.

In Figure 7(a), find intersection of apparent viscosity V_1 on 125 psi air pressure curve. A predicted flow rate of X_1 ounces per minute is obtained.

LIMITATIONS

1. Greases of NLGI No. 3 consistency or harder have not been tried in this method and may not be suitable.

2. Prediction of data for flow rates less than two ounces per minute may not be as accurate as that predicted at higher delivery rates.

3. Predicted pumpability data will be the most reliable when the Apparent Viscosity at 200 sec.$^{-1}$ vs. Temperature curves for the greases of interest have the same general slope as the grease actually used in the pumping procedure described in Part 1. ■

About the Author

R. D. Skoglund *graduated from the University of West Virginia with a BS degree in mechanical engineering. He joined Texaco, Inc. at its Beacon, N. Y., research center, where his work included application testing with greases and industrial oils, and fuel and lubricant evaluation in various internal combustion engines. He is now a group leader of the grease testing group in the products application department.*

Development of a Chart For Predicting the Pumpability of Greases

By: W. L. Gabbert, Lincoln Engineering Co.

Presented at the NLGI 27th annual meeting in New Orleans, October, 1959

THE KIND OF pump most commonly used for transferring and dispensing lubricants of all kinds is the compressed-air-operated piston-and-cylinder reciprocating pump. The pump, along with the hose that is connected to it, and the hand-operated valve at the end of the hose, make up into a system that is often referred to as a "grease gun". By utilizing the mechanical advantage that can be obtained through applying a force over an area, compressed air pressure is multiplied in the pump to a degree which is called the "ratio" of the pump. The more viscous the lubricant is, the more benefit there is to be obtained in using a pump of high ratio.

Customarily a fairly low ratio pump (around three to one) is used for pumping oils and a relatively high ratio (around 50 to one) is used for greases. In general, the gun is matched to the nature of the viscosity of the lubricant that is to be pumped.

Certainly the pump ratio is a significant factor in determining how much output will be obtained from the gun, both because of the pressure it allows, and because of the inevitable loss in output that must be sacrificed to obtain the desired high pressure. These two interacting characteristics, combined with the lubricant viscosity, add up to the well known but little understood quality of pumpability.

At one time, it was considered sufficient that the gun would pump oil or grease; today the question is invariably asked—"How much will it pump?" From the viewpoint of the pump manufacturer, the lubricant refiner and, quite importantly, the customer who uses the products of both, it is a tremendous advantage to be able to predict the flow rate of a specific lubricant through some particular pumping system. In the matter of oils, this sort of information is available. It has been simply a matter of pumping an adequate number of oils of known viscosity through the pump so that sufficient output-viscosity data are collected to permit charting the results.

Figure 1 shows two of these charts. The pumping system is illustrated on the graph and is seen to comprise a pump, some connecting pipe, hose on a reel and a metering type of hand valve. The meter is calibrated in quarts and for that reason the abscissa of the chart is in the same units. Because SUS viscosity is such a familiar measure, it is used as the ordinate.

One example will illustrate its use: A number 30 oil at 70° is to be dispensed by this gun. Available air pressure is 100 PSI. What output rate can be expected?

Reference to a viscosity chart brings forth the fact that number 30 oil at 70° has a viscosity of 1600 SSU. Applying this information to the chart, it is seen (by the heavy lines) that on the 100 PSI curve 1600 SSU intersects 5 qts. per minute, and this is the output realized. This chart can be used to predict the delivery rate of any pumpable Newtonian fluid whose SUS viscosity can be determined. The other chart illustrated here shows the delivery characteristics of the same pump with different accessories—hose and hand valve. As expected, the output rate is not the same as on the first chart. A significant point to be made here is that the two charts give more than just twice as much information as one chart, because from a very practical point of view quite good estimates can be made of the delivery characteristics of a system whose delivery line restriction lies between, as well as those

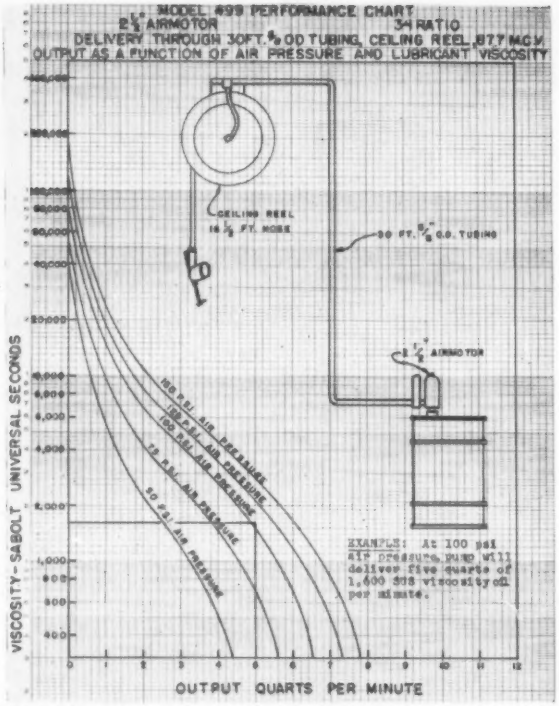

MODEL 499 PERFORMANCE CHART
2½" AIRMOTOR 34 RATIO
DELIVERY THROUGH 30FT. ⅜ OD TUBING, CEILING REEL, 877 MCV
OUTPUT AS A FUNCTION OF AIR PRESSURE AND LUBRICANT VISCOSITY
CEILING REEL
16⅓ FT. HOSE
30 FT. ⅜" O.D. TUBING
2½" AIRMOTOR
100 P.S.I. AIR PRESSURE
75 P.S.I. AIR PRESSURE
50 P.S.I. AIR PRESSURE
EXAMPLE: At 100 psi air pressure, pump will deliver five quarts of 1,600 SUS viscosity oil per minute.
VISCOSITY-SABOLT UNIVERSAL SECONDS
OUTPUT QUARTS PER MINUTE

FIGURE 1—A.

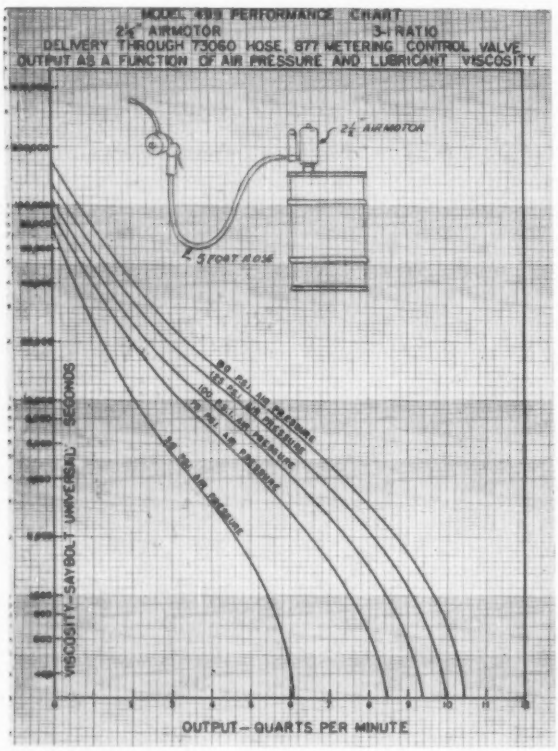

MODEL 499 PERFORMANCE CHART
2½" AIRMOTOR 3-1 RATIO
DELIVERY THROUGH 73060 HOSE, 877 METERING CONTROL VALVE
OUTPUT AS A FUNCTION OF AIR PRESSURE AND LUBRICANT VISCOSITY
2½" AIRMOTOR
5 FOOT HOSE
VISCOSITY-SAYBOLT UNIVERSAL SECONDS
OUTPUT—QUARTS PER MINUTE

FIGURE 1—B.

which lie on either side of these two charts. And at the site of the use of these charts, an estimate is often more worthwhile than the fine precision of carefully derived laboratory data. When a system is to be made up from components having normal production tolerances, it has been found wise when using an output chart to include a margin of safety that will take care of the cumulative differences that can build up in a standard model. Even with the above limitation of usage, the availability of output charts is an extremely worthwhile design tool.

Because of the high degree of usefulness of this type of chart, much thought has been given to the development of similar ones for non-fluid pumpables, which would include lubricating grease. This proposal is right in line with the endeavor of the NLGI Dispensing Panel's Cooperative Pumpability Studies. In its work, this NLGI group started out to determine the particular viscosity—actually apparent viscosity, since grease is non-Newtonian—at which the pumping system would deliver two ounces a minute, and this was to be called the limiting viscosity of the gun. Two ounces was selected as typifying the chassis bearing lubricant requirement. In specifying the apparent viscosity of the grease, a rate of shear of 200 sec.$^{-1}$ was decided upon; this figure is the outgrowth of an investigation to determine the likely shear rate in the grease gun system.

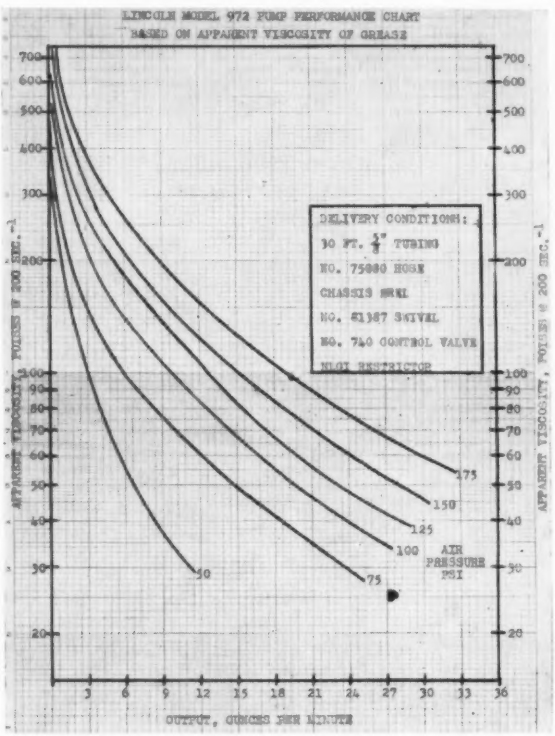
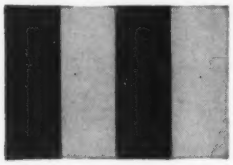


FIGURE 2.



Chassis Lubrication Committee

PROMOTION OF CHASSIS LUBRICATION

NLGI Committee Begins Intra-Industry Drive On 1,000-Mile Chassis Lube and Safety Inspection

THE CHASSIS Lubrication committee of NLGI, chairmanned by J. W. Lane (Socony Mobil), has begun an intensive drive within the industry to promote the 1,000-mile lubrication job and safety inspection. Like the motor oil study panel of the lubrication committee of the marketing division, API, this Institute group wants to halt the decline and make the motorist lube conscious. Like the API group too, this will take time and cooperation, but the industry can be encouraged in the productivity of API . . . there is an upward swing in motor oil sales.

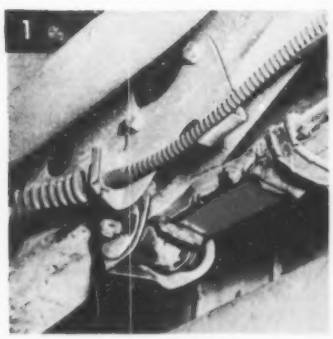
Lubricating grease promotions can be promoted by disseminating information and knowhow . . . when one firm has a mailing piece or a bill board posting the visual evidence it can be routed throughout NLGI, to spark more ideas and other treatments on this important subject.

An excellent example is shown on the next two pages . . . a special feature from the Sun Oil company dealer magazine, the *Sunoco Diamond*, with emphasis directed to the safety check obtainable when the car is on the lift. One page further and there is the Atlantic Refining poster asking an all too frequently ignored question. Finally, there is a suggested theme devised by former committee chairman H. A. Mayor, Jr. (Southwest Grease), and used in an article which appeared in the NLGI SPOKESMAN.

These are just a beginning . . . to stimulate the lubricating grease industry to put more emphasis on chassis lubrication, whether the company participating is marketing or manufacturing, is the prime purpose of this group. The chassis lubrication committee urgently invites comments, suggestions, aid, and above all . . . more material to distribute.

Another facet . . . to set up a program to find how wear can be reduced by correct chassis lubrication, under the guidance of the NLGI Technical Committee. More on this later.

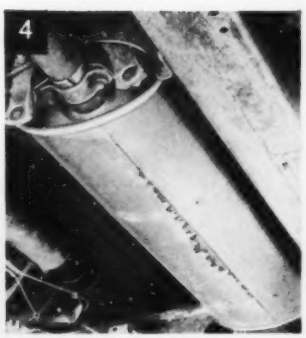
FRIENDS and members of the Institute are invited to participate in this new NLGI program . . . the Chassis Lubrication Committee will need further examples to mail out in the promotion of automotive lubrication, and all items telling the chassis lube story are welcome. Material should be sent to J. W. Lane, Socony Mobil Oil Company, 150 East 42nd St., New York 17, New York, or the NLGI national office in Kansas City, Missouri.



Spring bracket is broken on one side. If other side snaps, the wheel will go out of line, can throw the car off the highway.

Shock absorbers like this should be replaced. Bad bouncing on rough roads, sway on curves can cause the driver to lose control.

Wheel marked like this indicates leaking grease or brake fluid. If it gets on the linings, brake will grab, make the car swerve.



Muffler badly rusted lets exhaust gas get into car. Driver can be killed by gas or lose consciousness while driving.

To Make Sure Customers Come Back:

SHOWN below are eight conditions that can lead to accidents, injury or death. These were photographed on just four cars serviced at a Sunoco station—an average of two per car!

A check for such conditions during a routine chassis lube adds, at most, five minutes to the job. And, it might keep a customer alive to come back and buy more another day!

In addition, **look** for:

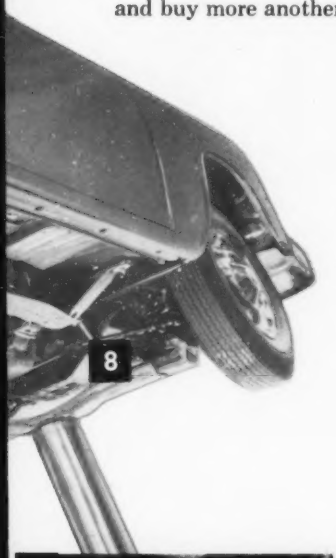
- Deep tire cuts, radial cracks and smooth tread.
- Steering box coming loose from the frame.
- Motor supports loose or broken.
- Broken spring leaves or loose U-bolts.

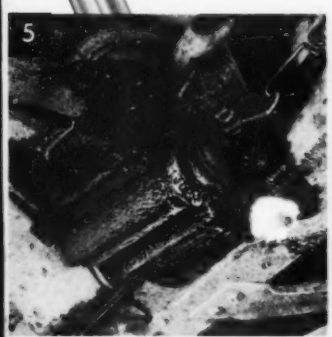
At the same time, a **shake** may find:

- Loose front suspension parts.
- Worn universal joints.
- Front wheels loose from worn king pins, loose tie rods or wheel bearings improperly tightened.
- Steering wheel with too much play.

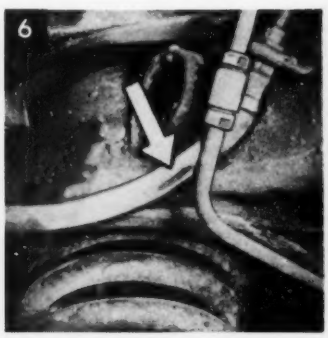
Naturally, you'll make sure all lights work. Moisture or discoloration inside a sealed beam is an indication it will soon burn out.

Even though you yourself may not be equipped to correct many of these conditions, it will pay you to spot them. Customers will appreciate the warnings . . . and live customers **do** buy more!

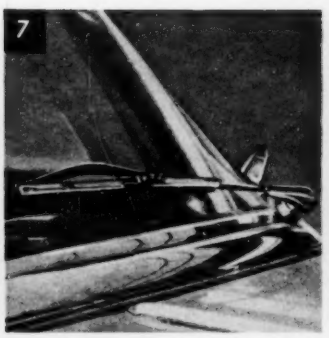




Master cylinder leaking brake fluid will soon operate brakes badly. If condition continues, car will end without any brakes.



Brake line rubbing gas line can wear enough to burst under pressure. Look, too, for lines that have cracks or cuts in them.



Windshield wiper has rubber torn almost off. A sudden rain, a smeary windshield and the driver won't be able to see at all.

Sway bar bushing has slid out of bracket along the bar. This car will sway badly and will be hard to control on the curves.

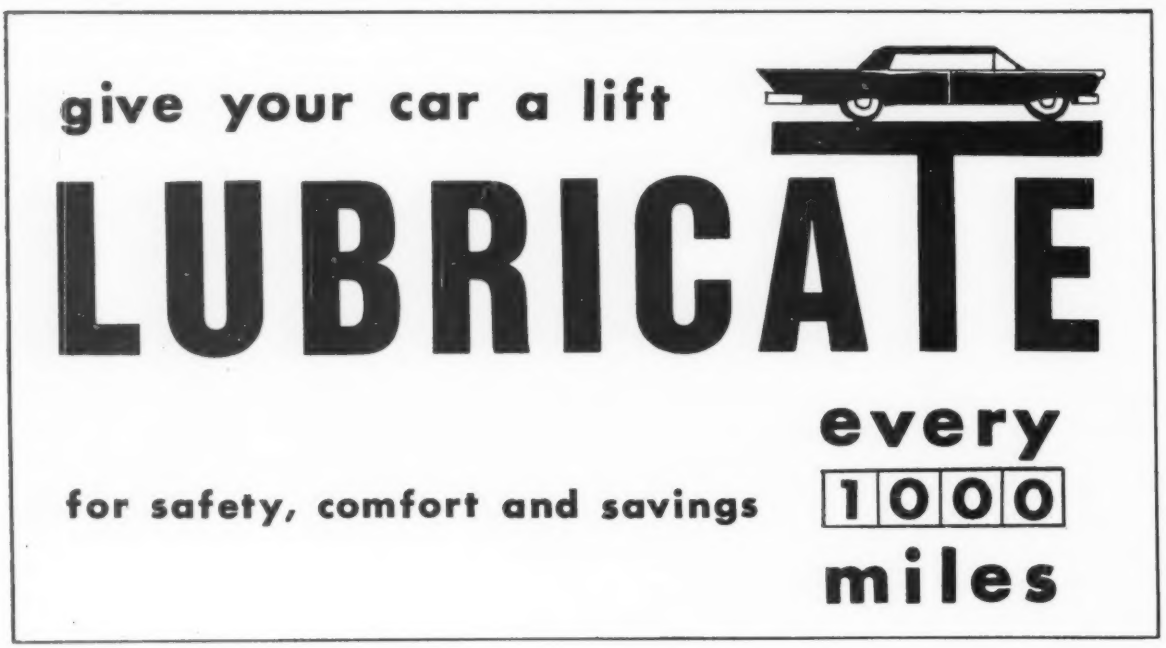
Chassis Lubrication Committee

Continued

Comments and attachments should be sent to J. W. Lane at Socony Mobil Oil Company, Inc., 150 East 42nd St., New York 17, N. Y. Other committee members include S. C. M. Ambler (British American), W. W. Albright (Indiana Standard), R. Cubicciotti (Sonneborn), J. J. Coates (Esso Standard), T. F. Shaffer (Shell), and F. W. Minor (Sinclair).

At the right is a photographic reproduction of the Atlantic Refining Company's "A" frame poster . . . measuring 28 by 44 inches, it is black, red, yellow, green and blue, shows up equally well from "A" frame or driveway office window.

BELOW, the initial work of the Chassis Lubrication Committee resulted in a number of ideas and slogans, one of which is shown here, as reproduced from an *NLGI Spokesman* feature reporting the work which had been done on the subject.



In its endeavor to develop a test method which best fills the need, the NLGI Panel has broadened its aims to include a pumping range rather than a single delivery rate. Work which began with a gun having a short length of delivery hose has been expanded to include a gun that is fitted with a hose reel and a specified length of connecting tubing. The scope of the testing procedure has widened so as to yield sufficient information for the preparation of grease delivery graphs similar to the oil delivery graph just shown in Figure 1.

Figure 2 shows the predicted form of the proposed graph. The abscissa in ounces per minute goes quite beyond the previously mentioned two ounces. The ordinate is apparent viscosity at 200 sec.$^{-1}$. Again, if lubricant viscosity and pump air pressures are known, rate of delivery can be picked off the graph.

Since there is so little difference between the pattern of the two graphs, it is reasonable to ask why the development of the grease delivery graph has lagged so far behind the oil charts. There are two reasons. The first is that SUS viscosity is a far more familiar term than is apparent viscosity; SUS figures are far more easily obtainable than apparent viscosity; the acceptance is far more assured on a familiar thing than on a less well-known one. The second reason is that there was some question about the use of a fixed shear rate (such as 200 sec.$^{-1}$) on the graph when the shear rate of the system as a whole was known to be a variable. With regard to the first item, several of the refiners have said that they will make available apparent viscosity figures on their lubricating grease; and as to the use of a selected shear rate (the 200 sec.$^{-1}$ mentioned earlier) we offer this line of reasoning.

At a fixed temperature and shear rate, the apparent viscosity of a grease is expressed as a number; this number can act as a label to identify the grease, much as does a brand name. And, if at the same time the apparent viscosity is being measured the grease is pumped, then the flow rate obtained can be correlated with the measured viscosity. For instance, if at 70° F., a lubricant is measured as having 500 poises apparent viscosity at 200 reciprocal seconds, and at the same temperature a pump delivers 8 oz./min. of the lubricant, it is not necessary to know what shear rate the pump system is producing nor the corresponding apparent viscosity of the lubricant in the various parts of the pumping system, since the lubricant is already identified by the pressure viscometer measurements at 200 sec.$^{-1}$ And similar pumpable substances which have 500 poises at 200 sec.$^{-1}$ would also have a pumpability of 8 oz./min. This should be true in spite of temperature, that is, a material with 500 poises @ 200 sec.$^{-1}$ at 40° should pump at the rate of 8 oz./min. at forty degrees. The pressure viscometer, then, could act as the yard stick for a number system which identifies the grease and the pump output is referred back to that yard stick. The results of the following test seem to back up this idea.

In Figure 3 you will recognize the dispensing system (the "long hose setup" it is called) used in conducting a series of tests to derive the data for the grease chart. This system comprises, in addition to the actual pump, 30 feet of 5/8-inch steel tubing, the length of hose on a reel, the hand operated contrivance called a control valve and a specified capillary known as the NLGI restrictor. The pumping system is intended to be representative of what is encountered in a typical filling station installation and

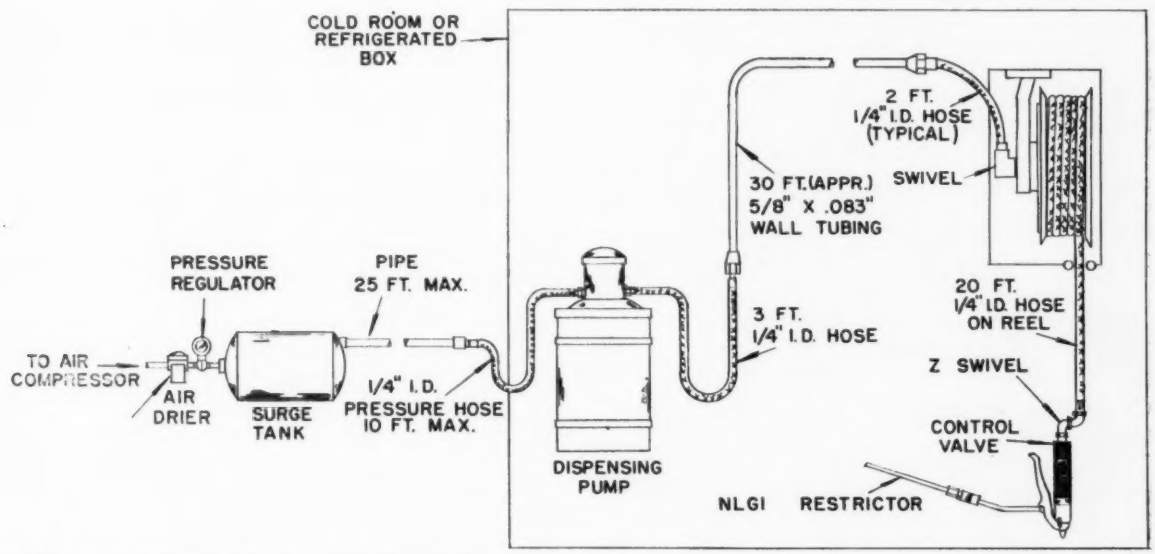


FIGURE 3—Test assembly for determining the delivery characteristics of pumps.

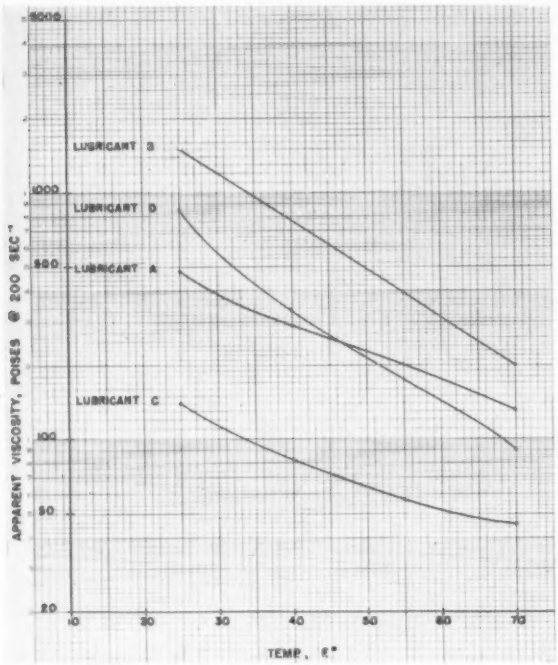


FIGURE 4.

the restrictor is designed to duplicate the back pressure (as it is called) in a bearing. Since temperature is an important factor in the flow character of a grease, the testing was done in a refrigerated room. In general, the method is that suggested by the NLGI Tentative Method for Matching Lubricating Grease Flow Properties with Lubricating Grease Dispensing Pump Delivery Behavior at Low Temperatures as it appeared in the September, 1955 SPOKESMAN, and follows very closely the Tentative Method as it stands today.

One part of the test consists of measuring the apparent viscosity of the grease using the ASTM Pressure Viscometer (Method D-1092). In the other part, the output of the pumping system is measured with the same grease and at the same temperature. Four test lubricants were used and tests were conducted at four temperatures, 70, 55, 40 and 25° F. The test lubricants,

Lubricant A—Lithim Soap, NLGI Number 2
Lubricant B—Sodium Soap, NLGI Number 1
Lubricant C—Calcium Soap, NLGI Number 1
Lubricant D—Aluminum Soap, NLGI Number 2

were selected for variety of composition and consistency.

Figure 4 is a plot of the apparent viscosity of the four lubricants with respect to temperature; these are the data obtained in the first part of the test. The corresponding flow rate figures are shown in the tabulation on Figure 5. It so happened that the apparent viscosity at 200 sec.$^{-1}$ for Lubricant A at 55° F., and Lubricant B at 70° F., were the same—200 poises. Also for Lubricant A at 70° and Lubricant C at 25° F. it was 140 poises.

Pump Air Pressure	*Test at 70° F.*	*Test at 55° F.*	*Test at 40° F.*	*Test at 25° F.*
	Output, Oz./Min. Lubricant A			
50 psi	0.27	0.21	0.085	—
75	3.02	1.37	0.42	0.26
100	6.45	3.16	1.05	0.59
125	10.11	5.28	1.75	0.86
150	14.00	7.35	2.62	1.20
175	15.75	9.42	3.25	1.52
App. Visc. @ 200 S^{-1}	140	200	290	485
	Output, Oz./Min. Lubricant B			
50 psi	1.34	0.40	0.05	
75	2.58	1.03	0.21	
100	3.90	1.55	0.31	
125	5.27	2.07	0.42	
150	6.47	2.42	0.43	
175	7.74	2.74	0.68	
App. Visc. @ 200 S^{-1}	200	390	720	1500
	Output, Oz./Min. Lubricant C			
50 psi	9.0	7.75	4.5	0.72
75	20.0	15.75	9.5	3.05
100	26.0	21.75	13.0	5.63
125	31.5	26	17.5	6.70
150	34.25	30.75	19.5	10.54
175	34.5	31.25	22.5	13.25
App. Visc. @ 200 S^{-1}	45	58	84	140
	Output, Oz./Min. Lubricant D			
50 psi	3.5		0.34	—
75	6.5		1.06	—
100	11.0		1.68	0.67
125	13.5		2.22	0.92
150	17.5		2.61	1.29
175	21.0		3.41	1.37
App. Visc. @ 200 S^{-1}	90		335	660

FIGURE 5.

A portion of these output and viscosity figures — the ones for pump air pressures at 50, 100 and 150 PSI —are plotted on Figure 6. On this chart it is seen that it is possible to draw an output curve (for a particular pump air pressure) that is a function of apparent viscosity even though: 1) the shear rate is not necessarily

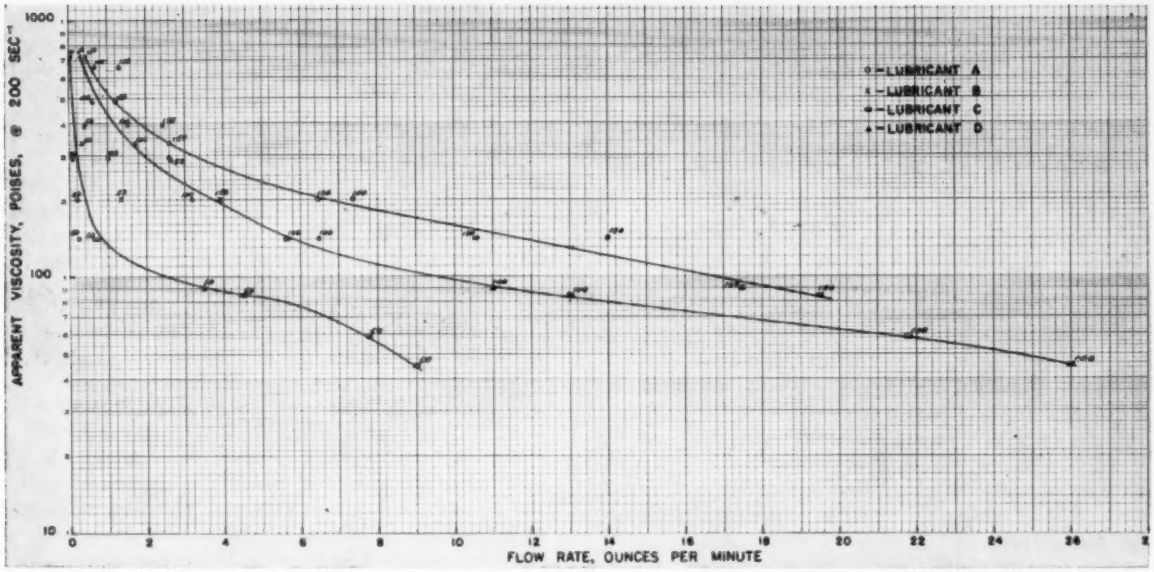


FIGURE 6.

that of the gun, and 2) the data are the composite of the result of four greases. These results would seem to bear out the validity of the idea of using the grease chart to predict the test system output of any ordinary lubricating grease within the limits prescribed in the Tentative Method. If, then, it is feasible to use apparent viscosity of grease at a fixed shear rate with somewhat the same freedom that SUS viscosity is used in describing oil flow characteristics, it follows that certainly there are many more applications of the grease chart than the filling station example that has been used so far. To mention just one, there is a broad field of industrial activity in centralized lubrication which could benefit materially by the grease chart as a design tool. In effect, the centralized lubrication pump, pouring its lubricant output through a progression of pipes and tubes to a multitude of bearings, is much the same sort of pumping-through-a-restriction problem as the long hose system that was shown in Figure 3. In a centralized system, the quantity of lubricant that is required can be determined by well-established empirical methods based on the system geometry. But there are two problems that are not so simply handled. Problem number one is this: Supposing that a centralized system requires x ounces of lubricant, per operation. How can one find out how many seconds or minutes are required to deliver this quantity, especially when temperature will effect the answer? In many centralized lubrication systems the successive operations are quite closely spaced in order to approach the ideal of continuous lubrication; it is well to know if one lubrication event can be fully executed by the time the next one is due. The other problem is much the same. If, for some good reason, it is considered advisable to shift to some other brand or grade of grease in a centralized lubrication system, can this be done without upsetting the time cycle equilibrium? Apparent viscosity on the grease chart seems to be the answer to both of these problems and the only thing that lies in the way is the time that is required to do the work in deriving suitable charts.

This sort of know-how benefits all concerned. As these charts are derived they would be made available upon request to the refiner, to the customer; in fact, anyone interested in the problem of pumpability. ■

About the Author

W. L. Gabbert *is attached to the engineering department of Lincoln Engineering company. He was formerly an instructor in the electrical department of the Ranken Trade school, St. Louis. Mr. Gabbert joined Lincoln at approximately the time that the company became active on the dispensing committee of NLGI and has participated in Lincoln's testing program contribution to the dispensing committee's activities.*

THE NLGI DISPENSING METHOD

Comment on Papers by R. D. Skoglund and W. L. Gabbert

By: M. Ehrlich, American Lubricants, Inc.

THE NLGI Dispensing Method is the culmination of an enormous amount of intelligent, well directed and diligent effort. These two papers detail the latest version of this method, which meets a real need.

Some years have passed since this method, in various forms, has been available. It is gaining in use, but cannot yet be considered to have received widespread acceptance. Perhaps this inertia is exhibited because the method appears to be more complex than it is. And with one simple modification, here given, the method will prove still easier to use.

In the first place, publicity is needed which shows only what the grease supplier must do to take advantage of this method. For each chassis lubricant marketed, he must develop one curve. This is taken from a series of eight or more readings using the ASTM pressure viscometer, Method D 1092-58. Mr. Skoglund says this, as previous authors have done. But many suppliers, only mildly curious at first, are apparently scared off at the volume of work reported, and which to the casual reader seems necessary. All the rest of the information given is historical, or indicates work to be done by other segments of the industry. The grease supplier's lab obtains the eight points illustrated in Figure 5, then draws one curve such as is shown in Figure 6 of Skoglund's paper. This requires no more effort than finding the E. P. value of an unknown grease on the Timken tester—perhaps even less. Here is the point that seems to need much more emphasis.

Meanwhile, the man who markets a grease pump

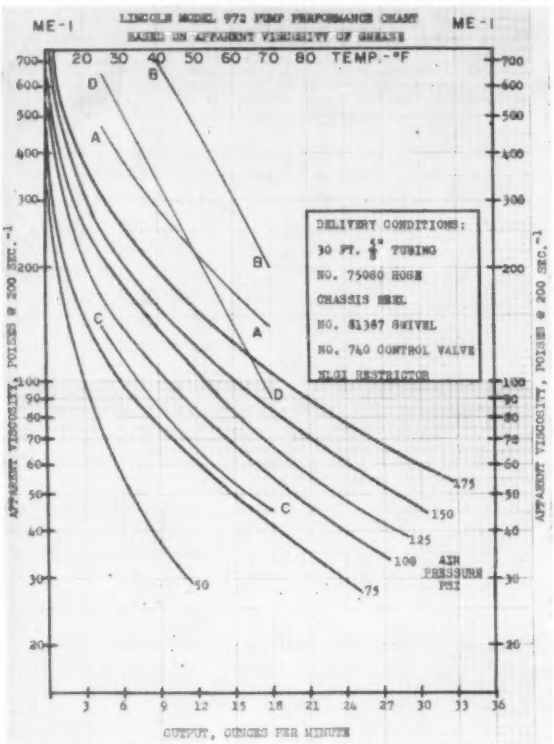


FIGURE ME-1.

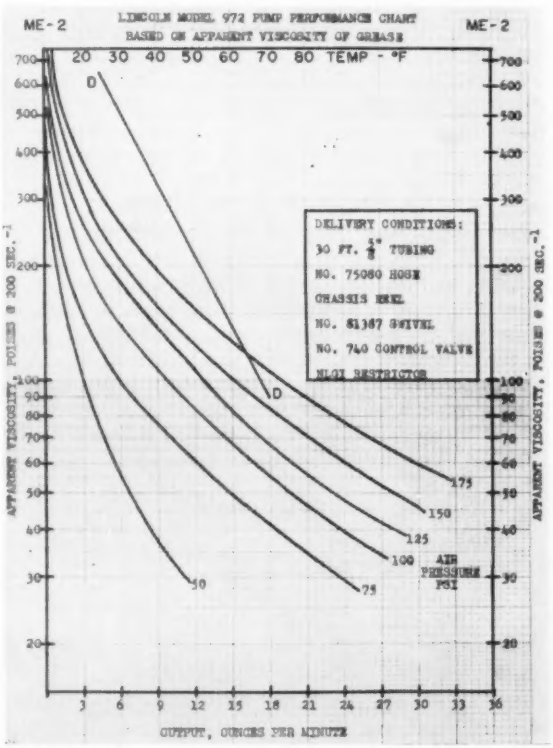


FIGURE ME-2.

for chassis lubricants has been working hard at describing his equipment. He does so in a series of curves such as Skoglund's Figure 3 or Gabbert's Figure 2.

The only step left is to derive the desired information from these two charts. Skoglund shows this as two charts in Figure 7. I believe we could simplify the operation by superimposing the two charts, easiest done right on the pump manufacturer's chart. A horizontal temperature ordinate should be laid out on the top, and the grease curve drawn right on the pump performance chart.

To illustrate this, the attached Figure ME-1 shows the four lubricant curves of Gabbert's Figure 4 drawn on the chart of his Figure 2. Since this describes four lubricants on one chart, it looks confusing. Thus Gabbert's Figure 2 was re-drawn, (Figure ME-2) using only one lubricant. D was chosen at random—any other could be used.

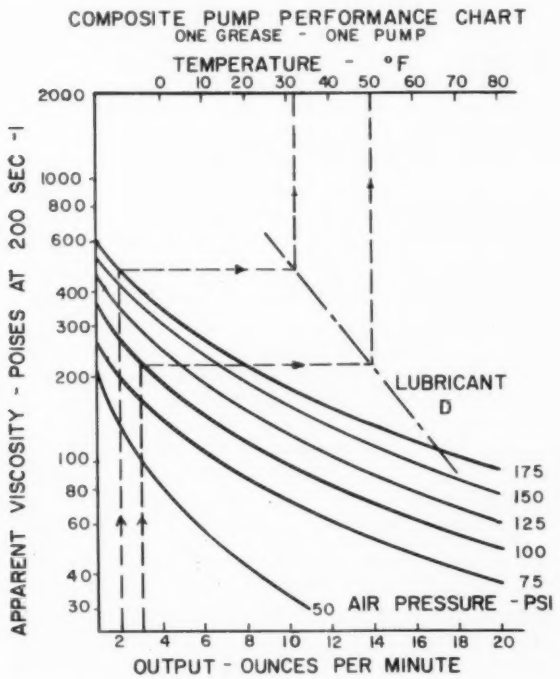


FIGURE ME-3.

TABLE ME-1

Pumpability of Lubricant D in Lincoln Model 972 Pump

MINIMUM TEMPERATURE AT WHICH GIVEN DELIVERY RATE WILL BE ACHIEVED

Delivery— oz/min	*Air Pressures, Psi*						
	50	*75*	*100*	*125*	*150*	*175*	*psi*
2	61	53	46	39	35	32	°F
3	67	57	51	44	39	36	
4	72	61	54	48	43	40	
5		64	57	51	46	43	
6		67	60	54	49	46	
7		69	62	56	51	48	
8			65	59	54	50	
9			67	61	56	52	
10			69	63	58	54	
11			70	65	60	56	
12				67	62	58	
13				69	64	60	
14				71	65	62	
15					67	63	
16					69	65	
17					70	66	
18						67	
19						68	
20						69	

As a further possibility, a somewhat different choice of graph paper may make the heavy lines more useful. Thus, with some inevitable approximations in going from one such drawing to another, Figure ME-3 shows the same data as Figure ME-2, redrawn on suitable semi-log paper (K&E 359-73). Now on one graph, the performance data for one lubricant in one pump are described. Any combination of delivery rate, air pressure and temperature, within the limits of the data given, can be derived from this one chart.

If additional co-operation can be obtained and universal agreement reached on the paper and ordinates, deluxe variations could include curves printed on transparent material, and superimposed one on the other. Or a series of values such as Table ME-1 may be drawn up matching one lubricant to one pump.

It is hoped that these comments will help make the NLGI Dispensing Method more palatable. If so, it will be used more widely. And it should be! ■

About the Author

M. EHRLICH *received his SB and SM degrees in chemistry from Massachusetts Institute of Technology in* 1933 *and* 1934, *respectively. He worked four years as a research chemist for National Aniline & Chemical Co., Buffalo. He then taught science at Seneca Vocational High school in Buffalo. In* 1942, *he joined American Lubricants, Inc., where he is now research director and vice-president. Active in ACS, ASTM, SAE, ASLE and NLGI, Mr. Ehrlich has contributed to the NLGI* SPOKESMAN *before.*

WHAT'S IN A NAME

definitions of terms relating to the lubricating grease industry

Part III

By W. J. Ewbank, Cato Oil and Grease Company

AS WE PRINT herewith, the third group of definitions, we are approaching the time when we should consider the possibility of taking another look at the entire group of definitions and printing them as a separate glossary of terms.

With this in mind, it is a good time to review the objectives of the program and see how well they have been accomplished in our work, and how they might be strengthened in the future when the permanent list is published.

Objective 1.

Our first objective has been to produce a set of definitions which is rigorous. Far too many terms have been used in the lubricating grease industry without proper definitions and with the meaning varying between various authors. Therefore, our objective in all cases has been to produce definitions which are capable of only a single interpretation.

In a few cases, where a word or phrase has two clearly distinct and easily distinguished meanings, dual definitions have been used.

Our worst difficulty has been those words such as appearance and texture which have been used for years to describe lubricating grease qualitatively, but which cannot be tied to quantitative tests. In fact, many of our correspondents on the Technical Committee have recommended that we not even attempt to define such terms because of the loose manner in which they have been always used and the difficulty of finding a definition acceptable (not to everybody—that would be impossible) to the great majority of the members.

In our opinion, it is just these terms which are most in need of definition. Technical terms, and those capable of being referred to a quantitative test and measurement scale have never been controversial, and defining them only would not be worth the time and effort of the Committee. However, to us on the Committee, being able to agree with our customers as to what actually constitutes a "short fibered grease" is justification for the extra effort involved.

Objective 2.

Our second objective is to make these definitions usable by non-technical as well as by technical people. For this reason many of the definitions have been supplemented by additional explanatory paragraphs in order to make their meaning fully clear. These comments are parenthesized to show that they are explanatory rather than part of the basic definition.

Objective 3.

Our third objective has been to be selective. Over the years, certain effects have been described by different terms used interchangeably. In each case, we have attempted to determine a preferred usage, usually by asking the membership of NLGI to indicate a preference. We have then defined only the preferred term, and have cross referenced the other terms to this definition.

We hope we have been successful in meeting these objectives in this third set of definitions, approved by

the Technical Committee at the October, 1958 meeting, and by the Board of Directors in 1959. We are currently working on the final form of a fourth set, and have a fifth in the process of preparation.

However, by the time these sets are finally published, we will have had several years of use of the first sets. We would like, therefore, to ask you to take another look at these first three sets and determine how well they have met our three objectives in the light of experience with their use.

With the publication of this set of definitions, I conclude my work as Chairman of the Committee on Definitions and Tests and turn the continuation of the program over to Mr. Albert Orr of the Gulf Oil corporation. Albert is very well known to the readers of the NLGI SPOKESMAN as the author of the article in the area of definitions which was so popular that it has recently been reprinted, and has been very closely associated with the work of this Committee as Vice-Chairman. I am sure that he will be able to continue with the program and finish it up in even more satisfactory form than we have been able to carry it thus far.

In conclusion, I would like to thank all of the members of the Technical Committee who have given generously of their time and efforts in answering the many requests for information which I have sent out on behalf of the Committee on Definitions, and especially those members of the Committee on Definitions past and present, without whose assistance I could not have accomplished even the amount so far completed.

DEFINITIONS

BLEEDING—The separation of liquid lubricant from a lubricating grease for any cause. (While excessive bleeding is harmful, a small amount of free oil can aid in lubrication).

CORROSION—The gradual destruction and/or pitting of a metal surface due to chemical attack. This chemical attack may be, but is not necessarily, due to the formation of acidic materials in the lubricant. See also FRETTING.

FALSE BRINELLING—See FRETTING.

FOLLOWER PLATE—A plate fitted to the top surface of lubricating grease in a container and so designed that as lubricating grease is dispensed, atmospheric pressure assists gravitational forces in delivering grease to the inlet of the dispensing system.

FRETTING—The removal of very finely divided particles from bearing surfaces due to inherent adhesive forces which are assisted by vibrating motion. The finely divided wear particles are then usually oxidized to a corrosion product which has led it to be called FRETTING CORROSION, although corrosion does not enter into the basic mechanism. It has also, in the past, been called FALSE BRINNELLING and FRICTION OXIDATION when it occurred in rolling contact bearings.

FRETTING CORROSION—See FRETTING.

FRICTION OXIDATION—See FRETTING.

INCOMPATIBILITY—Two lubricating greases show incompatibility when a mixture of the products shows physical properties or service performance which are markedly inferior to those of either of the greases before mixing. Performance or properties inferior to one of the products and superior to the other may be due to simple mixing and would not be considered as evidence of incompatibility.

INORGANIC THICKENER—See NON-SOAP THICKENER.

MECHANICAL STABILITY—See SHEAR STABILITY.

NON-SOAP THICKENER—Any of several specially treated or synthetic materials, excepting the metallic soaps of long chain fatty acids, which can be either thermally or mechanically dispersed in liquid lubricants to form lubricating grease. Also called SYNTHETIC THICKENER. Certain types are called INORGANIC THICKENERS.

RHEOPECTIC GREASE—A lubricating grease which has the property of increasing in consistency, (hardening appreciably) upon being subjected to shear.

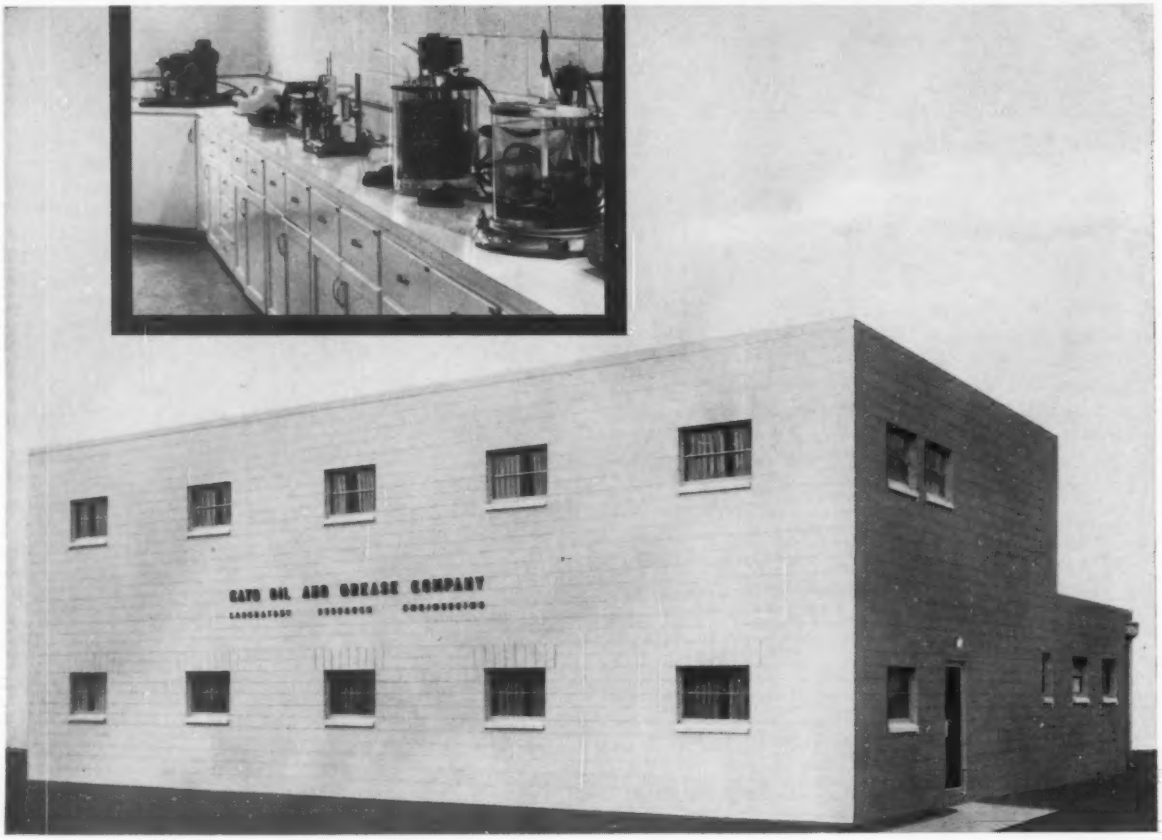
SHEAR STABILITY—The ability of a lubricating grease to resist changes in consistency (hardness) during mechanical working. Working may be in any of several types of laboratory machines or may be in actual service. This may also be called MECHANICAL STABILITY.

SYNERESIS—Loss of liquid lubricant from a lubricating grease due to shrinkage or rearrangement of the structure. The shrinkage may be due to either physical or chemical changes in the thickener. Syneresis is a form of BLEEDING.

SYNTHETIC THICKENER—See NON-SOAP THICKENER. ■

About the Author

W. J. EWBANK *has served seven years as chairman of the committee on the manual of test methods and definitions of terms in the lubricating grease industry, a project of the NLGI Technical Committee. He is director of research for Cato Oil & Grease Co. and a professor in the department of mechanical engineering at the University of Oklahoma, Norman. Professor Ewbank is a past contributor to the NLGI* SPOKESMAN.



NEW LABORATORY COMPLETED!

The heart of any oil and grease manufacturing plant such as ours is the laboratory.

In keeping with our $1,000,000 reconstruction program, necessitated by damage done by a fire last August, we have built a completely new laboratory from the ground up.

Though we have always been proud of the technological work of our chemists, this new laboratory will make it possible for us to do an even better job. It is larger than our previous facility and houses a greater variety of equipment—the newest and best ever developed for our industry.

In keeping with these expanded facilities, additional technicians have been employed—this means even faster, more efficient service to our customers in the future.

Doesn't it seem logical that a company such as ours, with a past record of performance and with a laboratory second to none in the industry, can be of service to your firm? We would appreciate the opportunity to custom-make oils and greases to your specifications.

CATO OIL AND GREASE COMPANY

Oklahoma City, Oklahoma

Literature and Patent Abstracts

Composition

Corrosion Preventive Lubricating Greases

According to British Patent 822,452 (Socony Mobil Oil company), soap-thickened lubricating greases containing small proportions of the reaction product of naphthenic acid and ethylene polyamines prevent rusting. A typical additive was prepared from 500 grams of naphthenic acid, having an acid number of 198, and 91 grams of diethylene triamine. This mixture was refluxed in xylene solution for four hours, then slowly heated to 275°C where it was held until evolution of water ceased.

A lubricating grease was prepared from 1.82 per cent stearic acid, 7.28 per cent 12-hydroxy stearic acid, 1.30 per cent lithium hydroxide and 88.85 per cent mineral oil of 500 SUS at 100°F and containing 0.75 per cent of a mixture of mono- and di-heptyl diphenylamines. One portion of this grease was heated to 300°F and 1 per cent of the additive made from the naphthenic acid and diethylene triamine was mixed in. This latter mixture used in a bearing corrosion test permitted no rust, whereas the same grease not containing the additive permitted rusting. In a lithium-calcium stearate grease, either 0.5 or 0.75 per cent of the additive failed to prevent rusting but 1 per cent was effective.

Silica-Thickened Grease Containing Carbamate Salt As Dispersant

According to Remes, Martinek and Fronczak (U.S. Patent 2,913,409, assigned to The Pure Oil Co.), the yield obtained with silica-thickened lubricating greases is improved if a carbamate is present in an amount of 2 to 15 per cent of the silica. It is also desirable to include 0.5 to 5.0 per cent by weight of a water-proofing agent for the silica, this to consist of a polyalkylene glycol. The preferred carbamate is a hydrocarbon-substituted ammonium hydrocarbon-substituted carbamate such as dimethylammoniumdimethylcarbamate which acts as a dispersant.

For example a mixture of 91.6 parts by weight of a 160 viscosity bright stock, 0.7 part by weight of Ucon LB 550X and 0.7 part by weight of N,N-dimethylammoniumdimethylcarbamate was heated at 190° to 205°F. and agitated while

If it rolls on an axle or turns in a
bearing or rides on a shaft if it slides
in a groove or moves on a pivot if
it bores or cuts or transmits pressure
one of Sinclair's 500 specialized lubricants
is designed to make it work better. For answers
to your lubrication problems, write today to
SINCLAIR REFINING COMPANY Sinclair
Technical Service Division, 600 Fifth Ave, N.Y. 20 N.Y.

Grease Marketers Can Profit From International's New Research Laboratory

Quality and dependable performance are prime requisites of grease marketers who value the integrity of their brand names.

One of the quality controls is the accurate determination of viscosity of lubricating oils at various temperatures.

This elaborate kinematic Viscosimeter, which costs several thousand dollars, allows a temperature control of remarkable accuracy. Such modern control methods enable International to guarantee efficiency and durability of greases under all possible operation conditions.

INTERNATIONAL LUBRICANT CORPORATION

New Orleans, Louisiana

Manufacturers of Top Quality Lubricants

AVIATION • INDUSTRIAL • AUTOMOTIVE MARINE

With Research Comes Quality, With Quality Comes Leadership

7.0 parts by weight of Cabosil was added. After maintaining this agitation and temperature for 90 minutes, the mass was passed through a colloid mill, set at 0.003 inch clearance, at a flow rate of 0.6 to 0.7 pounds per minute. The resulting lubricating grease after cooling had a worked penetration of 279.

This same carbamate when used as a dispersant for Bentone clay failed to produce a grease-like product but instead a fluid. Similar results were obtained when zinc dibutyl dithiocarbamate was used with fine silica.

Research on Vinylic Filler Lubricants and Greases

U. F. Nager, P. Davis and others (Burke Research Co.) PB 140, 478

This 43 page report is dated July, 1958.

The initial primary aim of this project was to develop new lubricating greases which would stand up under shear at temperatures up to 300°C. (preferably above 500°C.), to which they might be subjected under operating conditions. By amendment the scope of the contract was broadened to include (1) the preparation of new fluorinated liquid polymers (by telomerization and contact catalysis) and (2) the investigation of greases prepared therefrom by combining with cross-linked vinylic polymers of colloidal particle size. A further object of this study has been to develop new methods for preparing fluorocarbon dinitriles for use in ONR research work directed elsewhere toward producing fluorocarbon elastomers.

PB 139, 181, by Nager, Davis and Johnston.

This article covers the same subjects and consists of 23 pages. It can be secured as a photostat from Library of Congress for $4.80.

Processing

Manufacture of Mixed Base Sodium-Calcium Base Lubricating Greases

According to Chamberlin (U. S. Patent 2,915,468, assigned to Sinclair Refining company), the structure of anhydrous sodium-calcium

12-hydroxy stearate thickened lubricating greases is improved if the final 2.0 per cent of water is removed rapidly at a temperature of at least 300°F. Such treatment is said to change flat short thick straight soap fibers, which contribute to poor mechanical stability, to thin and narrow ribbon-like soap fibers with the larger fibers bent and intertwined, all of which contributes to excellent mechanical stability.

Thus, five parts of an oil blend having a viscosity of 126 SUS at 100°F and five parts of hydrogenated castor oil were mixed and heated to 200°F until the fat was melted, after which a 50 per cent water solution of the theoretical amount of sodium hydroxide was added. After the foam had subsided, one part of 12-hydroxy stearic acid was added and when this was melted, a slurry of one part of hydrated lime in seven parts of oil was mixed in. The temperature was then promptly raised to 345°F, held for one hour, dropped to 320°F where five parts of oil were added as the mass cooled to 300°F, followed by twenty-five parts of oil as the temperature dropped from 300 to 280°F.

Upon homogenizing, such a lubricant containing 17.2 per cent soap had a dropping point of 328°F and penetrations of 313 after 60 strokes and 355 after 100,000 strokes. The product had a bearing life of 1021 hours at 250°F. The same composition, dehydrated at a lower rate, failed to meet a maximum penetration of 375 after 100,000 strokes.

Loring in U.S. Patent 2,915,469, likewise assigned to Sinclair, found that the same fiber structure can be obtained if, after dehydration, three to ten per cent of water is added at a temperature between 300°F and the temperature at which the soap fibers melt. This added water is thought to dissolve the soap fibers so that as they dehydrate again they are reconstructed.

Thus, a sodium-calcium 12-hydroxy stearate grease prepared as described above, only subjected to slow dehydration, had a soap content of 20.0 per cent and a worked penetration of 324. Some of this mixture heated to 340°F where five per cent of water was added followed by holding at 340°F for 140 minutes, contained 16.0 per cent soap and had a 324 worked penetration.

Grease Manufacturing Process for Pigment or Dye Gelled Oils

When manufacturing pigment thickened lubricating greases, Armstrong and Woods (U.S. Patent 2,915,470, assigned to Shell Development company) found that a smaller proportion of thickener was required and a longer bearing life at high temperatures resulted if the oil-dye mixture was film dried at 300 to 350°F.

For example, mixtures of silicone fluid and a press cake containing 27 per cent indanthrene blue and 73 per cent water were paddle-mixed and dehydrated in a grease kettle followed by homogenization and heating in a forced draft oven for one hour at 450°F. The last two steps were repeated twice. Similar

Outside of
Mother Earth
the best container
for Petroleum products
is Vulcan steel pails
& drums
Strong! Leak-proof! Complete Variety! Available fast, in sizes from 1 through 55 gallons, with the industry's most complete selection of closures, styles, colors and Hi-Bake linings. These are some of the reasons why the nation's leading producers of oil and petroleum products ship those products in Vulcan Steel Containers. To learn all of the reasons, including the economy factor, write today!
Attach this ad to your calling card and mail today for ☐ free literature, or ☐ a meeting with your local 'Vulcansultant' a technical man who can help you with your container problems. • In California: Vulcan Containers Pacific Inc., San Leandro • In Canada: Vulcan Containers Limited, Toronto, Vancouver, B.C.
VULCAN CONTAINERS INC., Bellwood, Illinois, Phone: LInden 4-5000
NLGI-50

wet mixtures were passed to a thin film dryer, having a skin temperature of 330°F and a film thickness of 0.002 inch. After this the mass was heated as above to 450°F and then homogenized.

The variation in thickener proportions when given NLGI Grades of such lubricants were made by the two methods is shown in the accompanying table.

The No. 3 Grade prepared by the first process operated 64 hours in a bearing at 600°F before failing. Using the same grade made by film drying, failure occurred at 132 hours at 600°F.

NLGI Grease Grade	Weight Per Cent of Dye	
	Bulk Dried	Film Dried
No. 0	16-19	6-10
No. 1	20-23	11-15
No. 2	24-28	16-20
No. 3	28-32	21-25

Method of Preparing an Anhydrous Calcium Base Lubricating Grease

McCormick, in U.S. Patent 2,915,467 assigned to Sinclair Refining company, describes a method of structure-stabilizing anhydrous calcium base lubricating greases made from hydroxy fatty components. In such products in which the soap is calcium 12-hydroxy stearate and the dehydration takes place at a temperature not exceeding 260°F and to a water content of 0.3 per cent maximum, the stabilization is accomplished by further heating to about 280 to 285°F for about one hour. This latter heating should be at a temperature 5 to 20°F below the dropping point of the lubricant and for a period of 15 minutes to 3 hours.

For example, a lubricating grease was made, containing 8.0 per cent of calcium 12-hydroxy stearate, which was dehydrated at 250 to 255°F and cooled with a portion of the total oil, before being homogenized, to give a product with a worked penetration of 293 and a 296°F dropping point. A portion of this grease was reheated to 282°F for one hour to give a product with a worked penetration of 287.

Both the stabilized and unstabilized products were subjected to wheel bearing tests at 60 mph and 250°F. The reheated grease had no structure change and a leakage of 4.0 grams at the end of the test, whereas the original grease glazed and had a leakage of 6.6 grams. This reheating step can be carried

Penola
QUALITY
INSIDE

You can always count on Penola for the best in industrial and automotive lubricants. Manufactured and packaged to your exact requirements, Penola lubricants are readily available for sale under your own house brand. Our plants are strategically located to serve you better. Write or phone for complete information.

PENOLA OIL COMPANY
15 W. 51st Street, New York 19, N. Y.

Penola

out before all of the cooling oil is added in which case homogenizing is the last step.

Application

Explosion-Proof Lubricants
Anon. *Chemical Engineering Progress* v. 56, No. 11, January 1960 p. 130

Increasing use of tonnage oxygen has given a boost to halogenated lubricants which are finding application not only for equipment handling compressed oxygen but also machinery where corrosive substances are handled. Among such chemicals are mixed inorganic acids, caustic alkali solutions, oleum, fuming nitric acid, halofluoride gases and hydrogen fluoride.

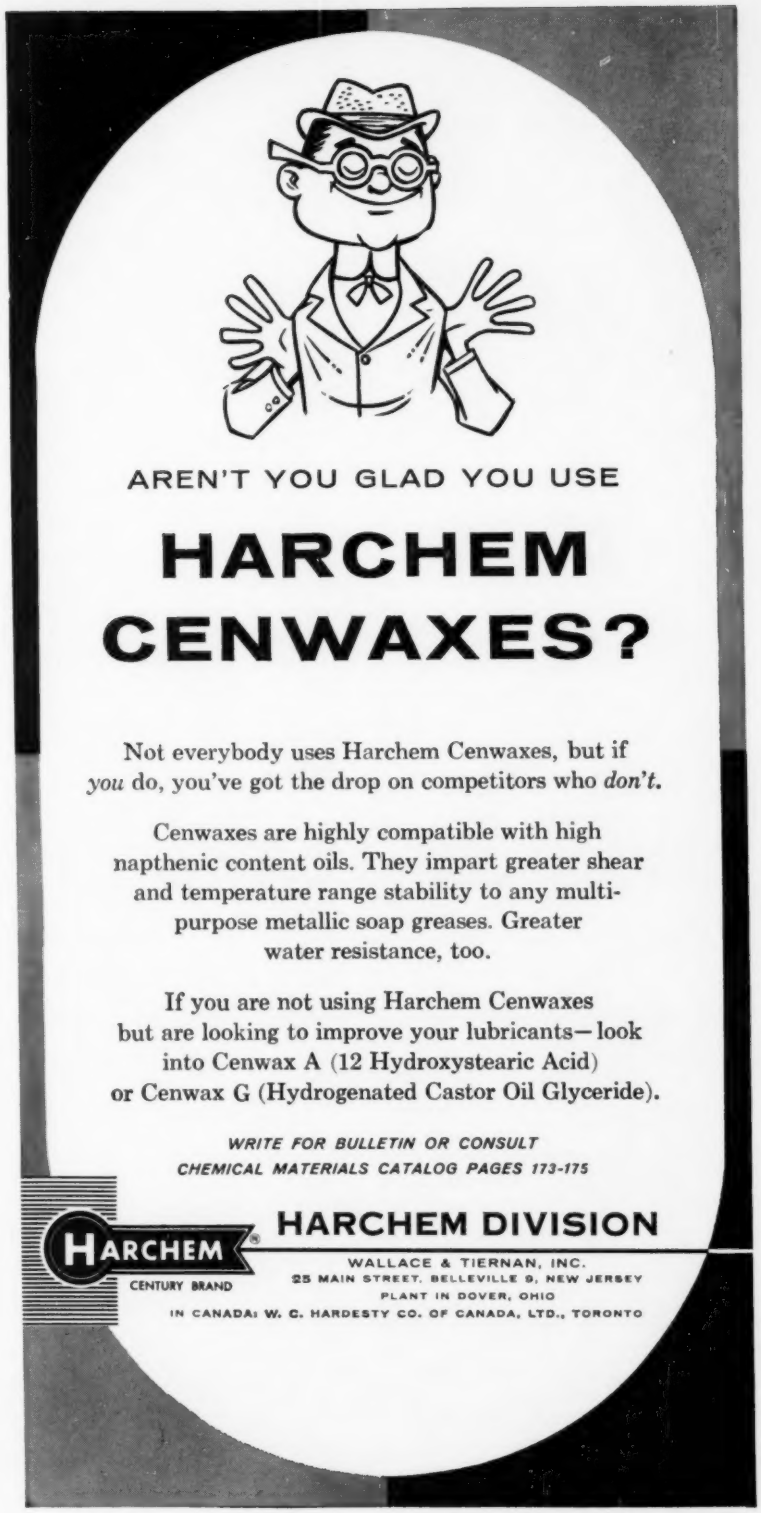
The suggested lubricants are saturated low-molecular weight polymers of chlorotrifluoroethylene. The polymerized product is separated by vacuum distillation into light or heavy oils, low melting point waxes, etc. These materials are chemically inert, have high density and high dielectric strength. Such halogenated lubricants are soluble in ordinary solvents such as mineral oil, chlorinated solvents, aromatics, acetone, butyl alcohol, etc. Also they may soften natural and some synthetic rubbers. Likewise with aluminum explosive compounds may result and copper is discolored at temperatures above 120°F.

Halocarbon lubricating greases consist of mixtures of the oil and wax fractions. The wax, because of its low solubility in the oil, acts as a thickener up to the point where it melts.

Printing Lubrication
***Lubrication*, Texaco Inc.**
December 1959, v. 45, No. 12

In a simplified lubricating plan for the Printing and Associated Industries, one lubricating grease is recommended. This is a No. 2 NLGI Grade of oxidation resistant, wide temperature range, sodium-calcium or lithium soap product containing an oil of 300 to 500 SUS at 100°F.

Of a total of 19 types of mechanisms listed for these industries, six require the use of the lubricating


AREN'T YOU GLAD YOU USE
HARCHEM
CENWAXES?
Not everybody uses Harchem Cenwaxes, but if *you* do, you've got the drop on competitors who *don't.*
Cenwaxes are highly compatible with high napthenic content oils. They impart greater shear and temperature range stability to any multi-purpose metallic soap greases. Greater water resistance, too.
If you are not using Harchem Cenwaxes but are looking to improve your lubricants—look into Cenwax A (12 Hydroxystearic Acid) or Cenwax G (Hydrogenated Castor Oil Glyceride).
WRITE FOR BULLETIN OR CONSULT CHEMICAL MATERIALS CATALOG PAGES 173-175
HARCHEM
CENTURY BRAND
HARCHEM DIVISION
WALLACE & TIERNAN, INC.
25 MAIN STREET, BELLEVILLE 9, NEW JERSEY
PLANT IN DOVER, OHIO
IN CANADA: W. C. HARDESTY CO. OF CANADA, LTD., TORONTO

grease and in one other application either grease or a heavy gear oil may be used.

Application—Gear Oils

Extreme-Pressure Lubricants For Marine Gears

A. D. Newman, *Scientific Lubrication*, December 1959, pp 35-39.

The first demand for E.P. oils for marine-geared turbines was for naval vessels where the gears were surface-hardened and where such gears had to transmit loads much greater than when conventional gears were used. Since that time E.P. oils have also been applied in merchant ships. Such use is justified for the initial charge since it allows rapid "bedding" of gears by protecting high spots against scuffing long enough for such irregularities to be smoothed off.

The author states that one of these reasons may lead to the use of E.P. oils for marine gears: first, the design may require a higher load-carrying capacity than is possible with a normal oil; second, even where the design does not demand such a lubricant a factor of safety may be desired; and third, an E.P. oil may permit the use of gear materials which would give trouble otherwise.

A test machine is described for E.P. oils in which two discs have perpendicular axes and such discs can be subjected to both varying loads and changes in the slide/roll ratios.

Testing

A Laboratory Evaluation of Extreme Pressure Additives

V. Oakes, *Scientific Lubrication* Vol. 11, No. 12, December 1959 pp. 16-18-24.

A testing apparatus designated as the "AC Lubricant Testing Machine" was used to evaluate sulfurized oils, chlorine compounds and chlorosulfurized additives. The machine consists of a Timken cup rotating in a batch of the lubricant being tested and bearing on a tapered Timken roller while, by a lever, measured pressures are applied to the contact line. If, after applying the load, no seizure occurs within 15 seconds the test is repeated with higher load until seizure does take place.

A comparison of the seizure load for several sulfurized oils with the OK load on a Timken EP Tester shows that no general correlation exists between the two test apparatus. Also, no mention is made of any relation between actual service results and the values obtained on the AC Lubricant Testing Machine.

***LUBRICATION*, Texaco, Inc.**

The December, 1959 issue of this publication contains a ten-year Index.

Eleven Grease references are given for various issues of the magazine. Six issues are cited as dealing with gears or gear lubricants.

Number Three in a Series . . .

OVER 30 YEARS OF PROGRESS

- Originators of the hot oil circulating system as a means of heat transfer for processing of greases.
- Installed the original Stratco contactor for soap making.
- Installed the first high-speed mills to be used as dispersers of soap into oil.
- The first grease manufacturer to deaerate mechanically all types of greases.
- The first to centrifuge all greases to remove impurities that normally pass through screens.
- All products used in the manufacture of greases are weighed to insure correct ingredients.

If we can help you, write, wire or call . . .

JESCO LUBRICANTS CO.

P.O. Box 7331 North Kansas City, Missouri GRand 1-4590

now available *now available*

NLGI SPOKESMAN

VOLUME XXIII

Latest Issue of Institute's Journal In Bound Volumes Offered to Readers

A reference work which is both handsome and practical . . . Volume XXIII of the NLGI SPOKESMAN contains the twelve issues between April, 1959 and March of 1960 . . . 36 features on every phase of the lubricating and fluid gear lubricants industries. Some categories:

> Automobiles . . . automatic transmission fluids . . . fatty acids . . . manufacture . . . non-soap . . . non-soap thickeners . . . testing . . . gear lubricants . . . marketing . . . non-lubricated bearings . . . und others.

The sturdy green cover holds all twelve issues securely, with an index in the final magazine broken down by author, title and category. A few copies of Volume XXI and XXII are also available. Write NLGI, 4638 J. C. Nichols Parkway, Kansas City 12, Missouri. $7.50 for members, $10.50 for friends of NLGI, plus postage.

Volumes I through XXIII may be purchased from University Microfilms, 313 North First Street, Ann Arbor, Michigan.

Industry News

Announces Improvement in Steel Pail Construction

Bennett Industries, Inc., Peotone, Ill. (40 miles southwest of Chicago) has announced a major improvement in the manufacture of steel pails. They are furnishing their customers planished side seams on all hi-bake lined pails. A planished side seam gives a continuous, flat, smooth surface throughout the interior of the body. There is no extra charge for planishing.

In all steel pails, the welded side seam has been a critical area. Coatings tend to pull away from the sharp edges of the seam, leaving it unprotected. Even a pinpoint imperfection along the side seam may start the corrosion process. Bennett has minimized the possibility of pinholing, with the flattened and smoothed side seam produced by planishing.

Since linings are generally used to protect hard-to-hold products, it is doubly important that the interior surface of lined pails be prepared properly so that the lining will cover every square millimeter perfectly. The planished side seam gives added assurance against the possibility of corrosion at the side seam area of the pail.

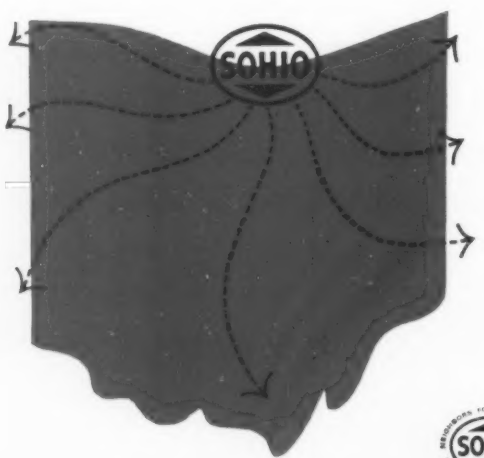
Interested parties may write to Bennett's customer service department for their planished side seam brochure with actual sample disks of planished and unplanished side seams to make their own "touch test."

More Advertising By Oil Companies

Oil companies are generally stepping up their advertising programs to grab bigger shares of the lubricant market, according to *Printer's Ink*, weekly magazine of advertising and marketing.

Noting that firms are banking more heavily on advertising all the time as competition intensifies, the trade journal added that 206 different companies took a total of 3,752 pages of lubricants ads last year in

Sohio brings you the quality stock oils you need . . . when and where you need them!



You're assured of prompt delivery of stock oils when you make Sohio your source of supply. That's because of Sohio's complete distribution system that brings stock oils to you *on time,* anyplace in the Midwest. And Sohio offers a complete line of high quality, dependable stock oils—paraffin or solvent—to completely meet the needs of any compounder or grease maker. Contact us now.

SOHIO

MIDLAND BLDG., CLEVELAND 15, OHIO

212 magazines . . . an increase over 1958 of 72 companies, 449 pages and six publications.

This new focus on lubrication finds most firms concentrating on getting customers to use higher grade, higher priced lubricants, *Printer's Ink* said.

Motor Oil Study Panel Reports

The Motor Oil Study panel of the Lubrication Committee, Marketing Division of the American Petroleum Institute, has been charged with the responsibility of halting the decline of motor oil sales. Heading the panel is R. Cubicciotti of Sonneborn Petroleum, who is also a member of the NLGI Board of Directors and formerly served as president of NLGI (1958). *Because of the parallel problem between motor oils and lubricating greases, the* NLGI SPOKESMAN *gives below a copy of Mr. Cubicciotti's report to the Lubrication Committee during its February* 25, 1960 *meeting in St. Louis*:

The developments in the work of this panel since its last report in November, 1959, have been as follows:

1. Operation Bootstrap

Our friends continue to supply us with samples of promotional material, which the panel redistributes to approximately 120 interested persons in our industry.

To date, eleven bulletins have been issued, attached to which were a total of 60 or 70 samples of promotional material.

Members of the Lubrication Committee are requested to send samples of new promotional material to the panel, for inclusion with future bulletins.

2. Contacts With Detroit

The advisory group reporting to the General Committee for Marketing has made no additional contacts with Detroit.

However, at its request, the Motor Oil Study panel arranged for a consumer survey to be conducted by Crossley, A-D Associates. The survey was limited to owners of new Ford, Chevrolet and Plymouth cars, and designed to determine what motivated the owners in their selection of cars.

Preliminary tabulations indicate the following:

(a) Of all reasons volunteered for the selection of the new car, "Frequency of Oil Drain" was never mentioned.

(b) When given sixteen typical reasons for making a choice, "Frequency of Oil Drain" ranked sixteenth with the Chevrolet and Plymouth owners, and fourteenth with the Ford owners.

(c) Present oil drain practice was reported as follows:

Chevrolet—1500 miles, harmonic mean

Plymouth—1600 miles, harmonic mean

Ford—2050 miles, harmonic mean

(Ford showed a big bulge at 4000-4500 miles)

(d) Owners ascribed their oil drain practices to the following:

Manufacturers (or Manual)..25%
Dealer recommendation 16%
To pretest engine 10%
All others 49%

(e) Chassis lubrication intervals

Chevrolet—1200 miles, harmonic mean

Plymouth 1250 miles, harmonic mean

Ford—1300 miles, harmonic mean

The results of this survey will be made available to our industry within the next few weeks.

The advisory group is studying the preliminary tabulations and has not yet decided how they should be used in contacts with the motor car industry.

3. Public Information Program

The public information program actually got under way on December 1, 1959, on which date the firm of Jones, Brakeley and Rockwell, New York public information experts, were appointed.

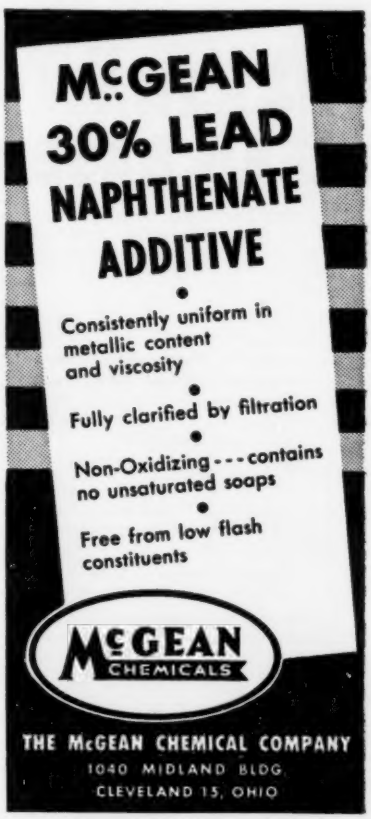
During the first 60 days, Jones, Brakeley and Rockwell spent their time doing research work and familiarizing themselves with the problem. Just recently, they started issuing releases, one of which has already appeared in the Chicago *American* and the Cleveland *Plain Dealer*.

New Automotive Multipurpose Lubricant

A new multipurpose automotive lubricant for commercial and fleet operation—for industrial, agricultural, construction and other heavy-duty motive equipment—has been announced by Shell Oil Co.

Shell Darina Grease AX is designed to lubricate mobile equipment under adverse and extreme climatic conditions. The lubricant is based on a new waterproof Microgel thickener developed in Shell research.

Sixteen large-scale operators of heavy-duty automotive equipment participated in a major field test program conducted by Shell. More than a thousand items of motive equipment were used in the program. Service conditions included city and over-the-road commercial vehicle operation—and heavy-duty equipment in such service as forestry, agriculture, construction, oil ex-



ploration and production, and others.

More tests were conducted for a year or more, with fleet mileages above a million in many instances. Test mileage on chassis parts was more than 30 million. Wheel bearing mileage was close to 17 million.

In the field tests, superior service characteristics were shown by Darina Grease AX in wheel bearings, shackles, kingpins, steering linkages and other chassis parts. The new grease proved appreciably better for wheel bearing lubrication than the greases formerly used by the participating companies. For chassis lubrication, Darina AX performed as well as or better than the greases used previously. Results were specially favorable to the new grease where heavy salting of roads in winter increased the severity of service conditions.

Where participating companies extended their lubrication schedules to take advantage of the properties of the new lube product, satisfactory performance was reported for longer operating periods.

Wet stability, mechanical stability and corrosion protection characteristics of Darina AX proved superior in both field and laboratory tests.

In oscillating friction tests—for service typical of chassis operating conditions—Darina AX served under wet conditions twice as long before failure as other premium multipurpose greases. Under dry conditions, the oscillating friction tests were terminated at 2,000 hours without failure by Darina AX. The best of the premium multipurpose greases tested failed in less than one-third the time.

Chek-Chart Publishes 1960 Lubricant Wall Chart

The 1960 Lubricant Recommendations Wall Chart has just been published by the Chek-Chart corporation.

The Wall Chart contains a ten-year coverage of the lubricants recommended and the capacities of the crankcase, transmission and differential for 24 makes of U. S. production passenger cars and 32 makes of the most popular imported passenger cars.

To further assist the stationman in providing expert service in the lube bay or on the drive, cooling system and gasoline tank capacities, and hood release and crankcase dipstick locations are also included.

In addition, the recommended lubricant for the crankcase, transmission and differential for sixteen makes of popular trucks and fourteen makes of school busses and motor coaches with similar coverage for ten popular farm tractors and five makes of motorcycles are also listed.

Coverage of lubricant requirements for outboard motors is also contained in the Wall Chart. The SAE number of the motor oil, the ratio of motor oil to fuel for two-cycle engine application, and the gear lubricant recommended, are all clearly tabulated.

New for 1960 are the lubricant recommendations for twelve popular lawn mower engines and for 25 makes of engines used on power chain saws.

The chart has been designed to provide the stationman with all needed lubricant and capacity information in an easy-to-use, stagger-fold chart with visible index tabs for instant reference.

Sonneborn Offers Bulletin On All-Purpose Grease

A bulletin on Amalie-brand all-purpose grease is available from Sonneborn Chemical and Refining, refiners and marketers of Amalie motor oils.

The bulletin covers the various uses to which the grease may be put, including application to chassis, wheel bearings, water pumps and universal joints.

All-purpose grease is manufactured from high-quality lubricating oils and a gelling agent, and is fortified with chemical compounds. The grease is said to be extremely stable and possesses a high degree of resistance to breakdown within the bearing.

It is available in one grade, in 400-pound, 100-pound, 35-pound and five-pound containers.

The bulletin also contains complete data on the grease and its primary uses.

Copies of the bulletin (Current Topics No. 14) may be obtained by writing Sonneborn, 300 Park Avenue South, New York 10, N. Y.

HARSHAW LEAD BASE

Harshaw Lead Base, as an additive to petroleum lubricants, improves extreme pressure characteristics and imparts the following desirable properties:

- Increased film strength
- Increased lubricity
- Improved wetting of metal surfaces
- A strong bond between lubricant and metal surfaces
- Resistance to welding of metals at high temperatures
- Moisture resistance and inhibits corrosion

Harshaw Lead Bases are offered in three concentrations to suit your particular needs:

Liquid 30% Pb	Liquid 33% Pb	Solid 36% Pb

Other metallic soaps made to your specifications. Our Technical Staffs are available to help you adapt these products to your specific needs.

THE HARSHAW CHEMICAL CO.
1945 E. 97th Street • Cleveland 6, Ohio
Branches In Principal Cities

DEEP ROCK

CYLINDER STOCKS

Fine Lubricating Qualities For Greases and Fluid Lubricants

Superior Specifications

Kerr-McGee Oil Industries, Inc.
Kerr-McGee Building
Oklahoma City, Okla.
CE 6-1313

Lincoln Film Shows How to Merchandise Lubritorium

A SCENE from Lincoln's new color-sound movie.

Lincoln Engineering company, NLGI Associate member active in the lubricating equipment field, has produced a new color-sound motion picture on how to merchandise the lubritorium for more sales of TBA and related services. Prints may be obtained by the industry without charge.

Entitled "You—the Jury," the picture offers convincing proof, dramatically demonstrated, that the lubritorium is the key to profit or loss. This timely, modern film stresses that the alert and proper operation of the lubritorium offers an unparalleled opportunity to build (or lose) customer good will.

Making its points in an amusing and yet effective manner, "You—the Jury" establishes its strong major point—merchandise the lubritorium as a "safety check" center and TBA, plus service profits will follow.

A fresh, light-hearted film which makes a serious point in eighteen minutes, "You—the Jury" may be obtained by writing Lincoln at 4010 Goodfellow boulevard in St. Louis.

Pure Introduces New Multi-Service Lubricant

A new grease that eliminates crunching and squeaking in ball-joint suspension systems and provides smoother rides and easier steering has been announced by the Pure Oil company. Called Purelube Golden-Grease, it is being introduced throughout Pure's 24-state marketing area.

The new lubricant contains a special additive that provides additional oiliness or "lubricity" and actually "grease-plates" metal parts. It not only ends ball-joint suspension noise but it stays put in all fittings under severe shock loading, the company says.

Golden-Grease is recommended as a multi-service lubricant and can be used in chassis fittings, wheel bearings, universal joints, fifth wheels and water pumps, all of which formerly required special greases.

According to Pure, Golden-Grease protects against wear because it won't splatter out of fittings under impact loads, protects against rust and oxidation, and is water-resistant. Its high, 380 to 390-deg. F. melting point is a safety factor in large trucks where the wheel bearings, clutch throwout bearings, water pumps and other lubrication points are near the brake drums.

The new grease is the result of two years of development and testing by Pure's research center at Crystal Lake, Ill. Extensive road tests have been made in many types of vehicles and under the most severe operating conditions.

API Booklets Tell How to Increase Motor Oil Sales

The nation's service station dealers are provided extensive information on how to increase sales of motor oil in two new booklets prepared by the marketing division of the American Petroleum Institute.

The new booklets, entitled "Know Your Motor Oil" and "How to Sell Motor Oil," are designed to help dealers sell motorists on the positive need for systematic car lubrication.

The API recommends systematic oil changes every 30 days in winter, every 60 days in summer, but never to exceed 2,000 miles.

Each of the two booklets are available at 25 cents per copy from the American Petroleum Institute, marketing division, 1271 Avenue of the Americas, New York 20, N. Y. Discounts will be given on orders over 100 copies.

FISKE BROTHERS REFINING CO.

Established 1870

★

NEWARK, N. J.

TOLEDO, OHIO

★

Manufacturers of

LUBRICATING GREASES

Lubricant Sample Program Begun by Alpha-Molykote

Free samples of Molykote G, a grease consistency lubricant which has proven to be a new production tool for industry, are being offered by the Alpha-Molykote corporation. Experience in Europe, as well as in the United States, has shown that this is the most universally useful of all the eighteen standard types produced by the company, which is the world's largest manufacturer of molybdenum disulfide lubricants for industry.

The small sample tubes of Molykote G are being mailed to over 20,000 production and maintenance engineers in the metalworking industry, and offered, by direct mail, to over 40,000 others concerned with industrial lubrication. Alpha-Molykote officials believe that the sample will help production and maintenance supervisors discover many useful and beneficial applications for the lubricant.

Molykote G is used throughout industry to eliminate fretting, galling, seizing and metal pickup in high bearing pressure applications such as heavily loaded gears, cold metal forming, threaded connections, etc.

The sample is being accompanied by a four-page, four-color bulletin which describes possible application instructions. Both the sample and Bulletin 126B may be obtained without cost from the Alpha-Molykote corporation, 65 Harvard Ave., Stamford, Conn.

The C. W. Nofsinger Company

CONSULTING ENGINEERS

Grease Plants
Petroleum Refineries
Petrochemicals

"In Engineering It's the People That Count"

307 East 63rd Street
Kansas City 13, Missouri

People in the Industry

Wallace & Tiernan Appoints Tyne Harchem Sales Mgr.

Charles H. Rybolt, vice-president in charge of chemical divisions for Wallace & Tiernan Inc., has announced the appointment of Edmond V. Tyne as sales manager for the Harchem Chemical department. Mr. Tyne replaces M. F. Antonovich who now heads up Harchem's purchasing department.

Upon his graduation from the Newark college of Engineering in 1938 with a degree in Chemical Engineering, Mr. Tyne joined the Irvington Varnish & Insulator company. In 1953 it was acquired by Minnesota Mining and Manufacturing company as Mr. Tyne became division sales manager. In 1959 he was promoted to eastern regional sales supervisor for 3 M's chemical divisions.

Mr. Tyne brings 22 years of marketing experience to the expanding operations of the Harchem division whose products include sebacic acid, specialty plasticizers, specialty chemical intermediates, di ester fluids for synthetic lubricants plus a broad line of fatty acids and their esters.

Dixon Elects Executive Vice-Presidents

H. Edward Ehlers and Warren A. Zimmer have been elected executive vice-presidents of the Joseph Dixon Crucible Co., Jersey City, N. J., it was announced by Frank G. Atkinson, president. Each had formerly been a senior vice-president.

Mr. Ehlers was graduated from the Penn Charter school, and in 1934 from Lehigh university. He joined Dixon in 1935 and was appointed manager of the crucible and refractories division in 1948. In promotions thereafter he was appointed industrial sales manager, general sales manager, vice-president and senior vice-president.

Mr. Zimmer, a ceramics engineer, was graduated from Ohio State university in 1935. A year later, after acquiring his master's degree, he joined Dixon's research department. He remained there until 1942 when he left to join the Army field artillery, from which he emerged four years later as a lieutenant colonel. He came back to the Dixon organization as assistant director of research and in 1950 he became general superintendent in charge of the crucible division, a position he held only a year before becoming works manager. He became a vice-president in 1956, and a senior vice-president last year. He is a member of the Society for the Advancement of Management.

Dixon and its six subsidiary companies comprise one of the world's largest manufacturing enterprises based almost wholly upon the application of graphite. Among the industrial output of the combined companies are graphite lubricants.

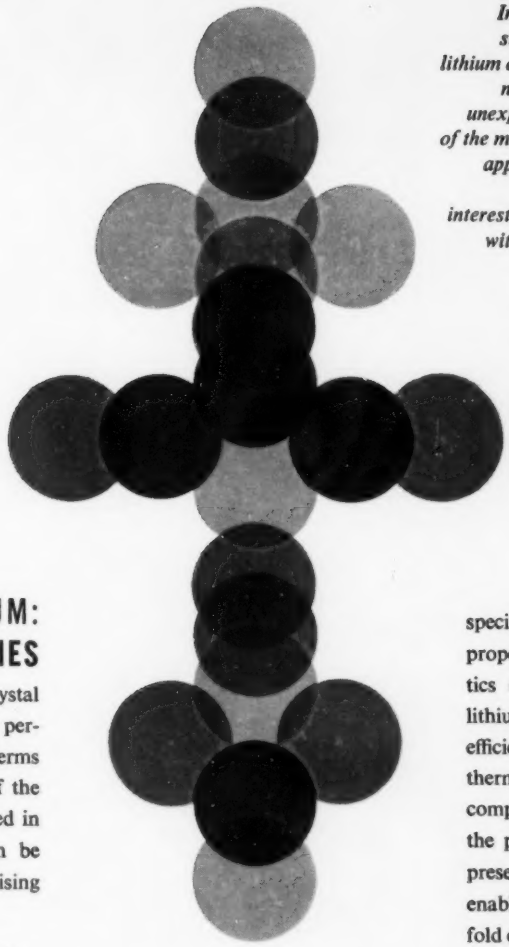
BARRETT *Filling* **LM** *Machine*

FOR GREASE AND OTHER VISCOUS PRODUCTS
- 4 interchangeable measuring cyls.
- Filling range 14 oz.—35 lbs.

AIR OPERATED
MANUALLY CONTROLLED
Write for Details.

BARRETT *Manufacturing Co.*
P. O. Box 8096, Houston 4, Texas

In lithium's differences lie its greatest strengths. Nominally an alkali metal, lithium does not always act like its Group IA neighbors . . . earning it the tag, "the unexpected element." The gratifying fact of the matter is that lithium's most promising applications reflect its most unexpected properties. A number of the more interesting properties, all of them concerned with the solid state, are discussed here.



THE CASE FOR LITHIUM: SOLID STATE PROPERTIES

The wide range of ionic or crystal radii displayed by the alkali metals permits their nominal classification in terms of other cations for which each of the alkali metal ions may be substituted in crystal lattices. Thus, lithium can be associated with 21 elements comprising small crystal ions.

Mg^{2+}, Al^{3+}, Ga^{3+}, Cr^{3+}, V^{3+}, Ti^{4+}, Fe^{3+}, Ge^{4+}, Mo^{6+}, W^{6+}, Ni^{2+}, Co^{2+}, Fe^{2+}, Zn^{2+}, Sc^{3+}, In^{3+}, Zr^{4+}, Hf^{4+}, Sn^{4+}, Nb^{5+}, Ta^{5+}

By comparison, the larger sodium, potassium, rubidium and cesium ions can replace few other cations without materially distorting or disturbing the existing arrangement of lattice units. This size factor . . . plus the ability of lithium ions to aid in stabilizing ions of higher valence state in a host crystal . . . is responsible for the interesting catalytic or semiconductor properties common to mixed lithium oxide—transition metal oxide systems.

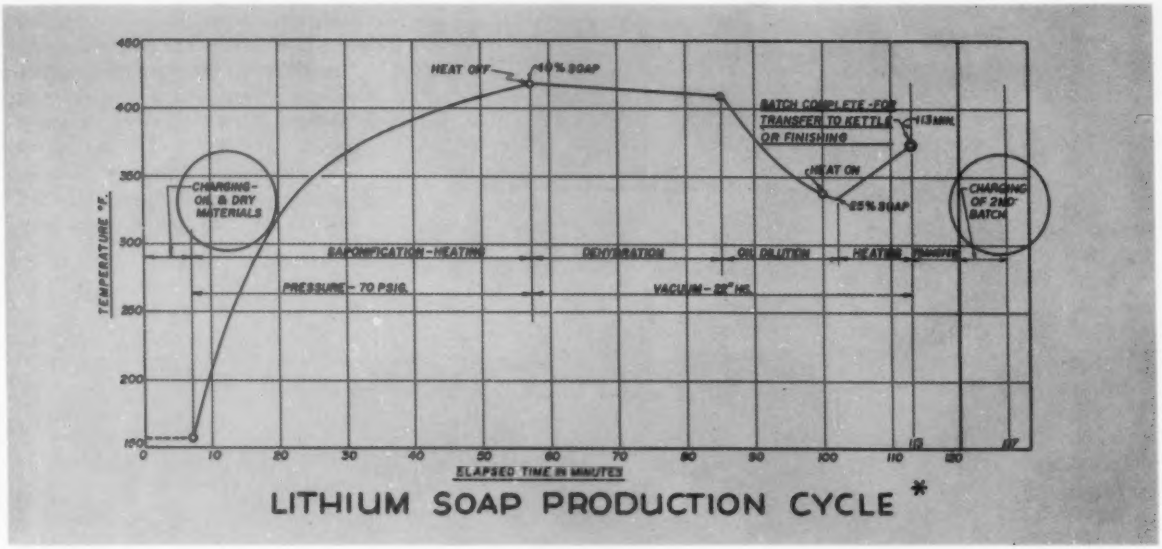
Oxides of the type:
$(Li_x M^{2+}_{1-2x} M_x^{3+}) O$ or $Li_x M_{1-x} O$,
where M is Mn, Fe, Co, or Ni, are p-type controlled impurity semiconductors of high electrical conductivity.

METALLURGY A small atom, plus high electronegativity permits lithium alone of all the alkali metals to be incorporated as a beneficial alloying constituent of numerous metals, including Mg, Cd, Al, Be, and Ag. In general, the lithium alloys of these metals exhibit increased strength and better working properties than the base material. One good example is the increased strength at higher operating temperatures of new aluminum-lithium alloy 2020. Lead-lithium alloys also have higher tensile strength than pure lead. By taking advantage of the excellent neutron absorption properties of the lithium-6 isotope, these alloys can be fabricated into excellent shields against thermal neutrons and gamma radiation.

CERAMICS The inclusion of lithium in glasses and glazes yields more condensed and compact structures with decreased thermal expansion and increased stability. It is still difficult to point to the specific atomic, molecular, and ionic properties on which these characteristics depend. But the growing use of lithium in ceramics with a very low coefficient of thermal expansion and high thermal shock resistance is being accompanied by increasing research into the physical chemistry of lithium. The presence of lithium in a glass structure enables the alumina ion to attain fourfold coordination, thus serving as a glass former. And lithium's small ionic radius permits a lithium ion coupled with an aluminum ion to displace two magnesium ions in the spinel structure.

MORE TO COME: The tale of lithium is neither easily nor quickly told. The material presented here constitutes the briefest of introductions. But if it has whet your appetite, we can happily provide you with more of the same—long on facts and ideas, short on flim-flam, and complete with derivations and references. Just write for a copy of "Lithium vs. The Other Alkali Metals". Foote Mineral Company, 402 18 West Chelten Building, Philadelphia 44, Pennsylvania.

FOOTE
MINERAL COMPANY

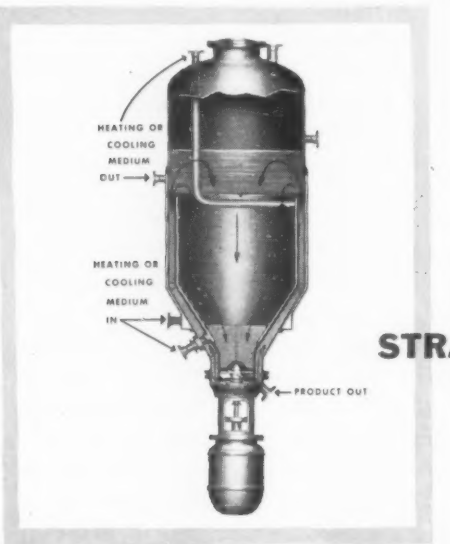


LITHIUM SOAP PRODUCTION CYCLE *

From base stocks to . . . finished soaps . . . in less than 2 hours

with STRATCO CONTACTOR

**Other types of soaps generally require shorter cycles . . .*



Stratco Grease Manufacturing has proved the most efficient method of producing today's great variety of greases because of:

- Complete and rapid saponification
- Extremely close temperature control
- High heat transfer rates
- Immediate and uniform dispersion
- High yield greases
- Reduced manpower requirements

STRATCO—the choice of economy and quality minded grease manufacturers for over 30 years.

REPRESENTATIVES

D. D. Foster Co., Pittsburgh, Pa.
D. D. Foster Co., S. Charleston, W. Va.
Lester Oberholtz, Los Angeles
Rawson-Houlihan Co., Inc., Houston
The Rawson Co., Inc., Baton Rouge
F. J. McConnell Co., New York

STRATFORD ENGINEERING CORPORATION

• PETROLEUM REFINING ENGINEERS

612 West 47th St. Kansas City 12, Mo.